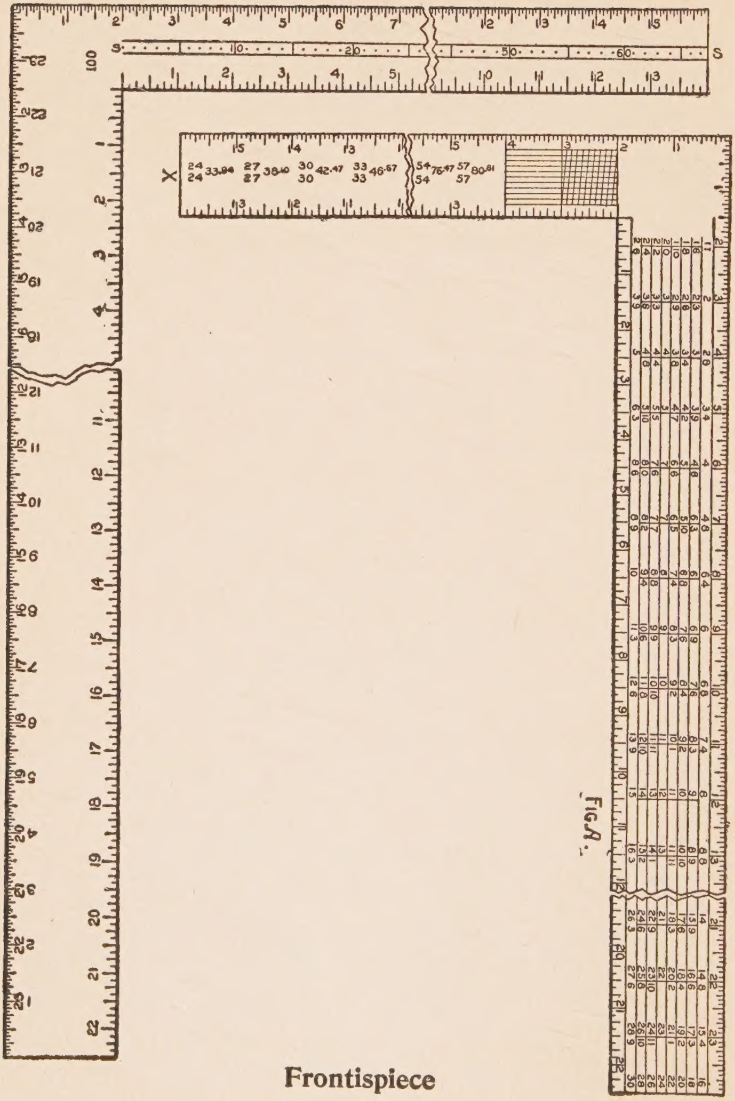
STEEL SQUARE

AND ITS USES



Frontispiece

THE STEEL SQUARE
AND ITS USES

A Complete, Up-to-date Encyclopedia on the Practical Uses of the Steel Square, Showing How it Can be Used by the Carpenter in His Daily Work, Together with a Detailed Discussion of the Various Devices now on the Market Which Aim to Simplify the Work which can be Done with this Wonderful Tool

IN TWO VOLUMES

EDITED UNDER THE SUPERVISION OF

WILLIAM A. RADFORD

Editor-in-Chief of the "American Carpenter and Builder," President of "The Radford Architectural Co.," and the Best Authority in the Country on all Things Pertaining to the Building Trade

ASSISTED BY

ALFRED W. WOODS

Associate Editor of the "American Carpenter and Builder," Inventor of "Woods' Key to the Steel Square," and the Recognized "World's Greatest Expert with the Steel Square."

AND

WILLIAM REUTHER

Editor of the "American Carpenter and Builder," and one of the most Thorough and Practical Writers on Modern Building Methods.

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PREFACE

We have endeavored, as far as possible, in preparing this second volume to follow the general plan laid out in Volume I. Nearly all of the subject matter is new and original with us, and the practical side has been presented wherever possible. Considerable space has been devoted to the department of Questions and Answers. These answers to specific questions will, undoubtedly, be one of the most valuable parts of the book, as they all refer to things met with in your daily work.

We feel that, in these two volumes, we have brought the subject up to the present day, and have given it a thorough, practical and comprehensive discussion.

WILLIAM A. RADFORD.

Chicago, Ill.

Vol. II

The Steel Square

And Its Uses

Part I

MISCELLANEOUS RULES. Measurement — To find number of yards of plastering or painting — To divide a board into equal parts — To obtain diagonal of parallelogram — To find circumference of a circle — To find side of greatest square in a circle — To determine proportions of cylindrical bodies — To determine center of a circle — To find square of equal area to a given circle, etc.

THE following rules and examples have been gathered from various sources, and although they touch upon topics already treated, they are here presented with the confident belief that the reader willfind among them a number of easy solutions of problems that heretofore have caused him much time and trouble to work out.

Measurement.—Let us suppose that we have a pile of lumber to measure, the boards being of different widths, and say 16 feet long. We take our square and a bevel with a long blade and proceed as follows: First we set the bevel at 12 inches on the tongue of the square, because we want to find the contents of the board in feet,

12 inches being one foot; now we set the other end of the bevel blade on the 16 inch mark on the blade of the square, because the boards are 16 feet long. Now, it must be quite evident to any one who would think for a moment, that a board 1 foot wide, and 16 feet long, must contain 16 feet of lumber. Now let us take a board 11 inches wide, and 16 feet long, we just move our bevel from the 12 inch mark to the 11 inch mark, on the tongue, and look on the blade of the square for the true answer; and so on with any width, so long as the length is 16 feet. If the stuff is two inches thick, double the answer, if three inches thick treble the answer, etc.

Now, if we have stuff 14 feet long, we simply change the bevel blade from 16 inches on the square blade, to 14 inches, keeping the other end of the bevel on the 12 inch mark, 12 inches being the constant figure on that side of the square.

To Find Number of Yards of Plastering or Painting.—If we want to find out how many yards of plastering or painting there are in a wall, it can be done by this method quite easily. Let us suppose a wall to be 12 feet high and 18 feet long, and we want to find out how many yards of plastering or painting there are in it, we set the bevel on the 9 inch mark on the tongue (we take 9 inches because 9 square feet make one square yard, (we take 18 inches, one of the dimensions of the wall, on the blade of the square; then after screwing the bevel tight, we slide it from 9 inches to 12 inches, the latter number

being the other dimension, and the answer will be found on the blade of the square. It must be understood that 9 inches must be a constant figure when you want your answer to be in yards, and in measuring for plastering it is as well to set the other end of the bevel on the figure that corresponds with the height of the ceiling, and then there will be no movement of the bevel required further than to move it on the third dimension. This rule is a very simple and a useful one; of course openings will have to be allowed for, as this rule gives the whole measurement.

To Divide a Board Into Equal Parts.—Fig. 145 shows how to divide a board into an even number

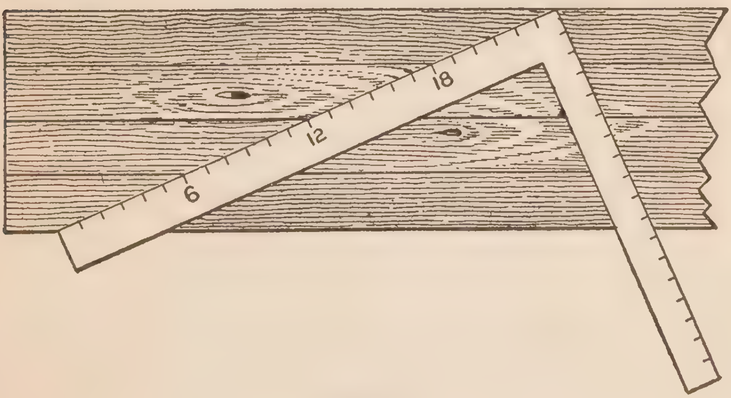


FIG. 145

of parts, each part being equal, when the same is an unequal number of inches, or parts of an inch in width. Lay the square as shown, with the ends of the square on the edges of the board, then the points of division will be found at 6, 12, and

18, for dividing the board into four equal parts; or at 4, 8, 12, 16, and 20, if it is desired to divide the board into six equal parts. Of course the common two-foot rule will answer this purpose as well as the square, but it is not always convenient.

To Obtain Diagonal of Parallelogram. — If the diagonal of a parallelogram withint he range of the square is required, it can be obtained as follows: Set the blade of the bevel on $8\frac{3}{4}$ inches on the tongue of the square, and $12\frac{3}{8}$ inches on the blade; securely fasten the bevel at this

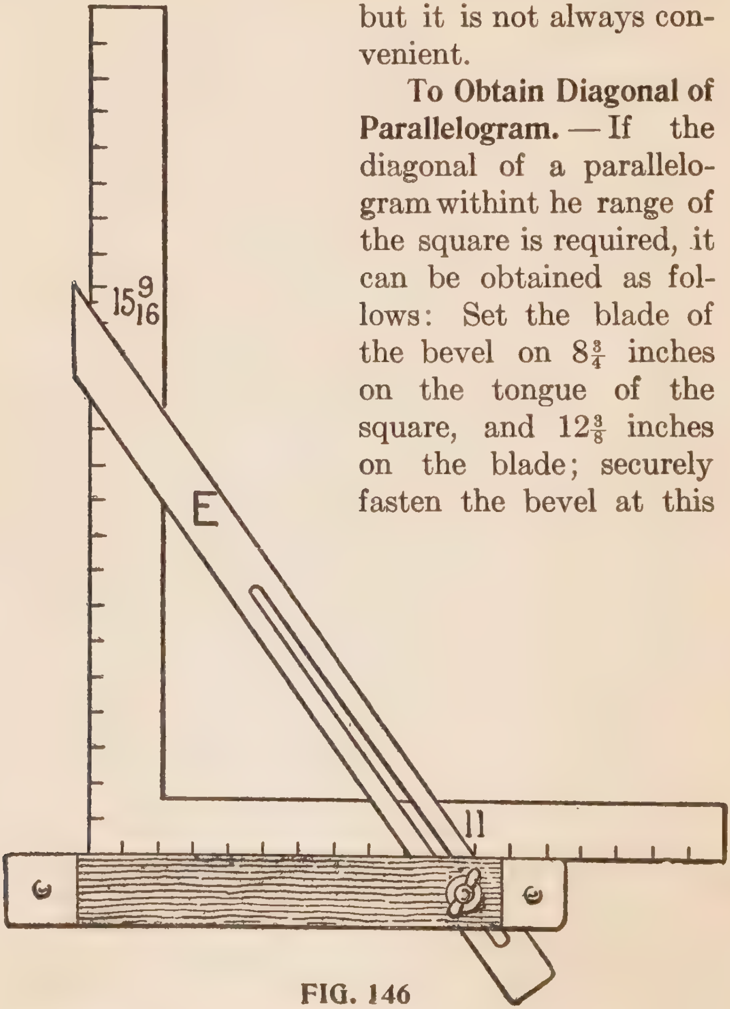


FIG. 146

angle. Now, suppose the parallelogram or square as in Fig. 146 to be 11 inches on the side, then move the bevel to the 11 inch mark on the tongue of the square, and the answer, 15 and 9-16, will be found on the blade. All problems of this nature can be solved with the square and bevel as the latter is now set. There is no particular reason for using $8\frac{3}{4}$ and $12\frac{3}{8}$, only that they are in exact proportion to 70 and 99. $4\frac{3}{8}$ and 6 3-16 would do just as well, as they are in the same proportion.

To Find the Circumference of a Circle with the square and bevel proceed as follows: Set the bevel to 7 on the tongue and 22 on the blade; move the bevel to the given diameter on the tongue of the square, and the approximate answer will be found on the blade. When the diameter is wanted the operation is simply reversed, that is, we put the bevel on the blade and look on the tongue of the square for the answer.

To Find Side of Greatest Square in a Circle.—If we want to find the side of the greatest square that can be inscribed in a given circle, when the diameter is given, we set the bevel to $8\frac{1}{2}$ on the tongue and 12 on the blade. Then set the bevel of the diameter on the blade, and the answer will be found on the tongue.

To Determine Proportions of Cylindrical Bodies.—In Fig. 147 is shown a method to determine the proportions of any circular presses or other cylindrical bodies, by use of the square. Suppose the small circle, N, to be five inches in diameter

and the circle R is ten inches in diameter, and it is required to make another circle, Z, to contain the same area as the two circles N and R. Measure line a, on the square, from five on the tongue to ten on the blade, and the length of this line A from the two points named will be the diameter of the larger circle Z. And again, if you want

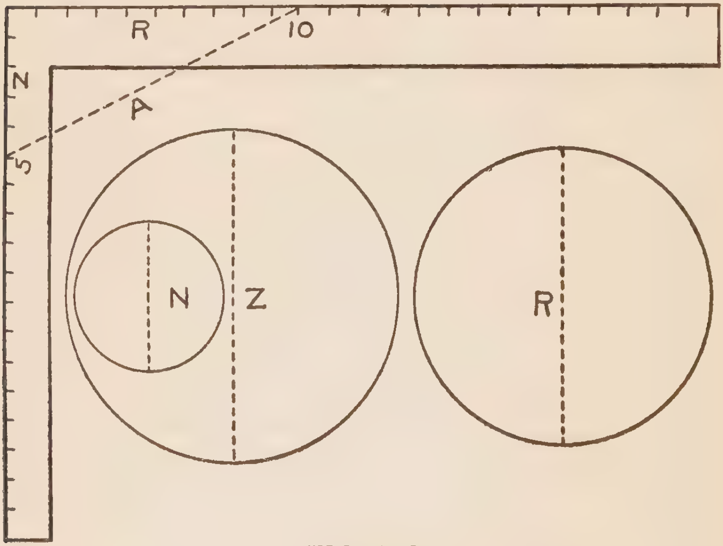


FIG. 147

to run these circles into a fourth one, set the diameter of the third on the tongue of the square, and the diameter of Z on the blade, and the diagonal will give the diameter of the fourth or largest circle, and the same rule may be carried out to infinite extent. The rule is reversed by taking the diameter of the greater circle and laying diagonally on the square, and letting the ends touch

whatever points on the outside edge of the square. These points will give the diameters of two circles, which combined, will contain the same area as the larger circle. The same rule can also be applied to squares, cubes, triangles, rectangles, and all other regular figures, by taking similar dimensions only; that is, if the largest side of one triangle is taken, the largest side of the other

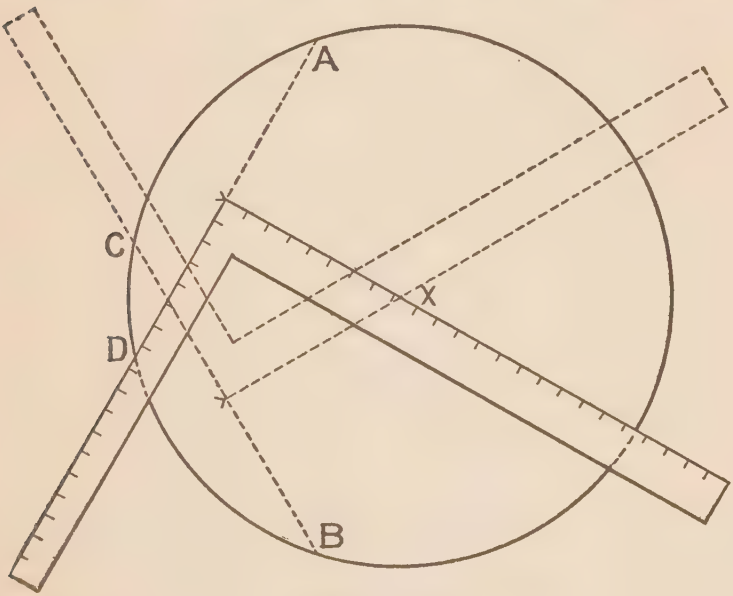


FIG. 148

must also be taken, and the result will be the largest side of the required triangle, and so with the shortest side.

To Determine Center of a Circle.—In Fig. 148 we show how the center of a circle may be determined without the use of compasses; this is based

on the principle that a circle can be drawn through any three points that are not actually in a straight line. Suppose we take A B C D for four given points, then draw a line from A to D, and from B to C; get the center of these lines, and square from these circles as shown, and where the square

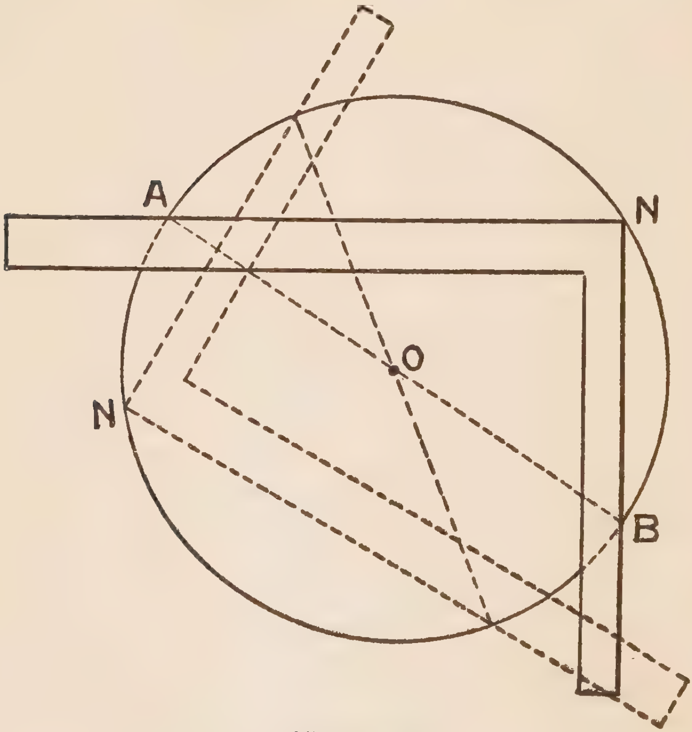


FIG. 149

crosses the line or where the lines intersect, as at X, there will be the center of the circle. This is a very useful rule, and by keeping it in mind the mechanic may very frequently save himself

much trouble, as it often happens that it is necessary to find the center of the circle, when the compasses are not at hand.

Another Quick Method of finding the center of a circle by means of the steel square is shown in Fig. 149. Let N N, the corner of the square, touch the circumference, and where the blade and tongue cross it will be equally divided; then move the square to any other place and mark in the same way and straight across, and where the line crosses A, B, as at O, there will be the center of the circle.

To Find a Square of Equal Area to a Given Circle, we set the bevel to $9\frac{3}{4}$ inches on the tongue, and 11 inches on the blade; then move the bevel to the diameter of the circle on the blade, and the answer will be found on the tongue. If the circumference of the circle is given, and we want to find a square containing the same area, we set the bevel to $5\frac{1}{2}$ inches on the tongue and $19\frac{1}{2}$ inches on the blade.

To Obtain Circumference of Circle of Given Diameter.—There are quite a number of methods of obtaining approximate proportions of the diameter of circles to their circumferences. The true proportion, or, as it is sometimes expressed, the squaring of the circle, is one of those feats, like the discovery of perpetual motion, and is as far from being accomplished as ever. At any rate, it makes but little difference at this time to the operative mechanic, whether the circle can be squared or not, so long as he can get near enough

to the truth to satisfy the requirements at hand satisfactorily, and to aid him in this, the following method is shown of obtaining the circumference of circles when the diameter is given, by use of the square. Of course, as shown in the cut the rule will apply to circles of any reasonable dimensions.

Let A B, in Fig. 150, be a straight line, or the straight edge of a board; then apply the square as shown, placing the 16 inch mark on the blade at C, and the 5 inch mark on the tongue at D. See that the junctions of the blade and tongue of the square with the line A B, are accurately placed, for on this depends the truth of the results. Now, suppose we wish to ascertain the circumference of a circle whose diameter is 8 inches; commencing at the point, C, we space off the diameter, 8 inches, three times, on the line C O, as shown at 8″ 8″ 8″; then square down the line 8″ F, then C F will be the circumference of a circle whose diameter is 8. It will be seen, by dotted lines in the cut, that the circumference equals the diagonal of a rectangle whose sides are respectively 24 and 7 and 15-32 inches; so that by adopting these figures (24 and 7 and 15-32), it enables the operative to use the full length and capacity of the square. The better way however, is to work from a basis of 16 and 5, and draw the lines, C O and A B, to considerable length, so that they may be made available for dimensions beyond the range of the square. Now, let us suppose an instance where the circumference of a circle is wanted,

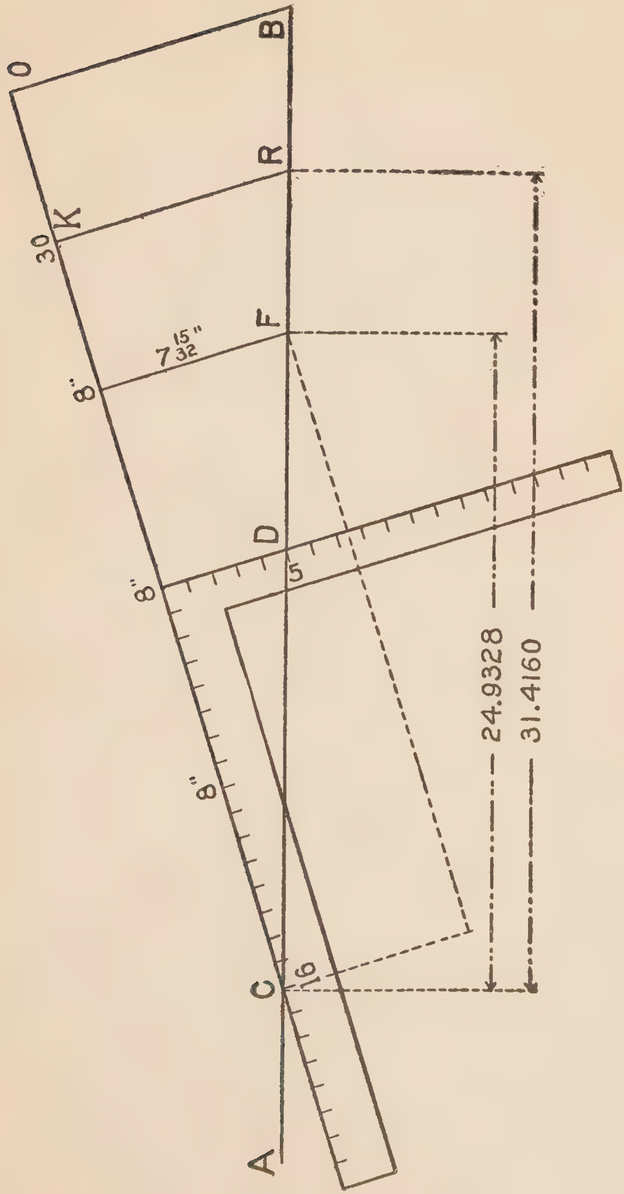


FIG. 150

whose diameter is 10; we simply space off three tens, or thirty inches, on the line C O, which, in this case, is at K. Square down from K to R, and C R is the length sought.

Now, to prove this, let us proceed as follows: Diameter = 10 x 3.1416 = 31.4160, or nearly thirty-one inches and fifteen thirty-seconds of an inch. Now, if we measure C R, we will find that the

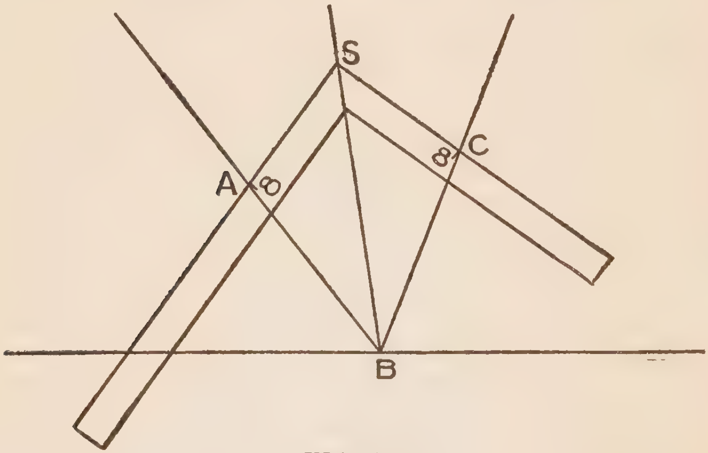


FIG. 151

distance is exactly 31.4160 inches, and is, therefore, the answer sought. It will be seen by these examples that the circumference of circles may be easily obtained when the diameters are known. So, also, may the diameters be found when the circumferences are known, for by laying off the circumference on the line A B, as C D in Fig. 150 for instance, and then applying the square as there exhibited, and dividing the distance from the

heel of the square to the point C into three equal parts. One of these parts is the diameter of the circle whose circumference equals the distance from C to D.

Method of Dividing Angles.—A B C, Fig. 151, is an acute angle. We wish to divide it. Measure up from B to A any distance, make B C the same distance, place the square on the points as shown on A and C, keeping the distance on the blade and tongue the same, then the heel or corner of the

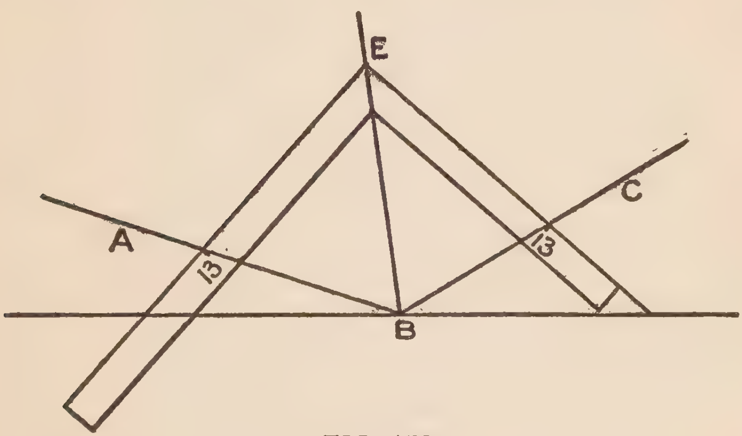


FIG. 152

square, S, will give the points through which to draw a line passing through the angle at B, and the division will be complete.

Again: Let Fig. 152 be an obtuse angle; make B A and B C equal. Apply square as shown, keeping equal distances on the blade and tongue at the points of contact A and C. The point E on the heel of the square will be one point from

which to draw a line through B, which forms the division of the angle.

In Fig. 153 we show a number of angles, which are treated same as the foregoing. At the junc-

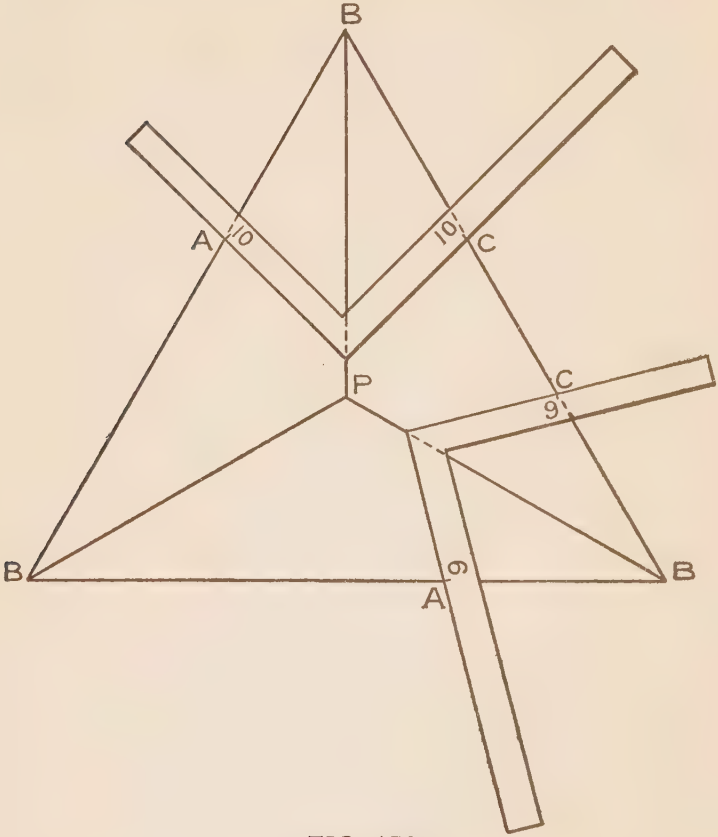


FIG. 153

tion of the lines drawn from the angles B B B, the center of the triangle is found at P.

This method of bisecting an angle is very use-

ful, inasmuch as the cut or miter of any mouldings placed at any angle on a flat surface may be obtained. This is shown at Fig. 154, which may

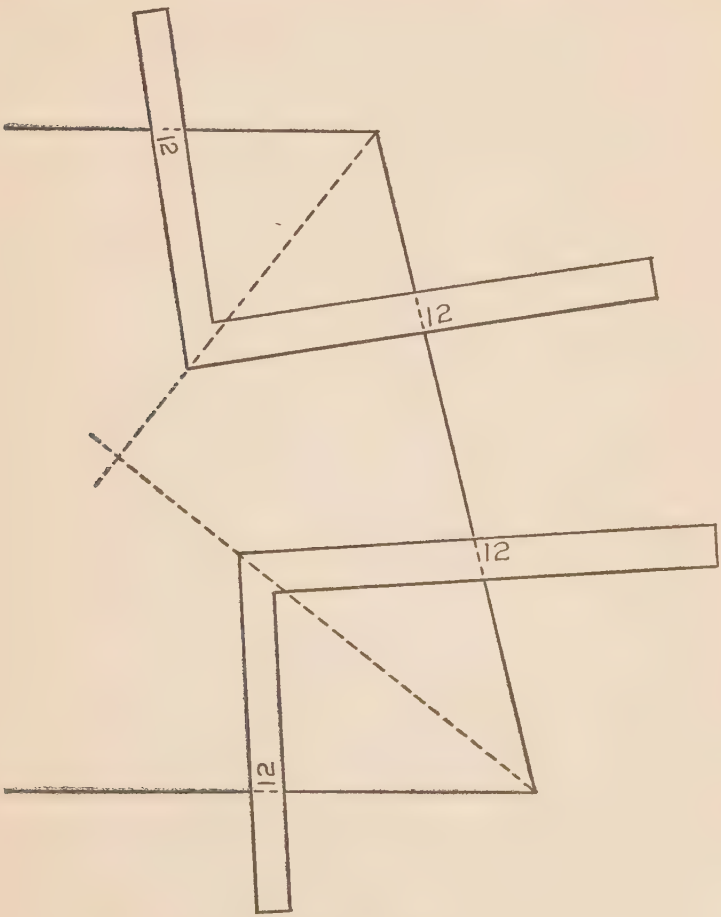


FIG. 154

be a panel or other like surface. This diagram shows that angles of any form and in any posi-

tion may be equally divided by a proper use of the steel square.

To Form a Template or Set Square.—Suppose we want to find the angle 45 degrees on a board, we mark any two points A C, Fig. 155, on the edge of a board; apply the square as shown, keeping its sides on A C; then the distance on each side of the square being equal, measuring from its

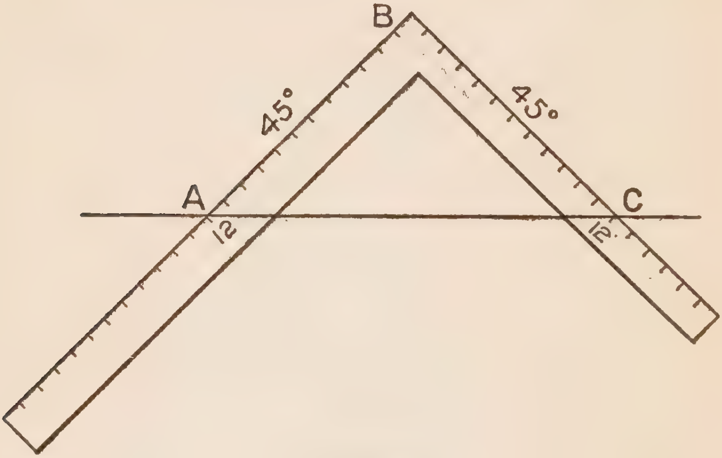


FIG. 155

heel or corner B gives the angle 45 degrees. If this portion be cut out it will form a templet or set square, which is very useful in drawing. The lines A B and C B are true miters, or angles of 45 degrees, with the line A C as their base.

In Fig. 156, A, B, C, R show the lines for forming a set-square having 60 degrees on the line C R, and 30 degrees on A R. This figure is formed with compasses, as follows: Make A C length of

base line; let B be half the distance between A C. From C B as centers and radius make the intersection at R, then by joining A R and C R the angles 30 degrees and 60 degrees are formed. This is the principle. To do all this with the

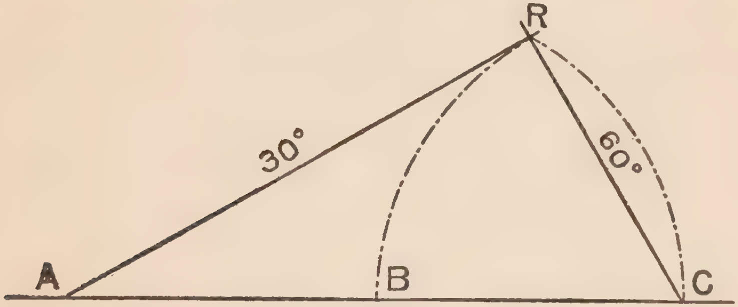


FIG. 156

square, simply take 23 inches on the blade and 13 inches on the tongue, and place these points on the line A B C, Fig. 157, and you have the angles at once. If the figure is greater than the square

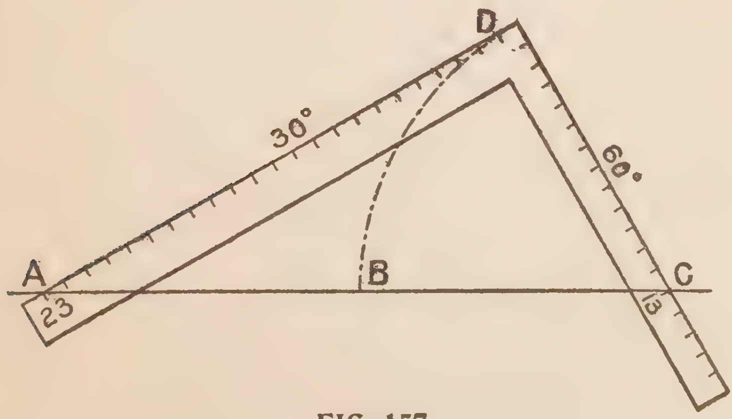


FIG. 157

can cover, then continue the line A D to the length required; then square down until the line cuts A B C, and the work is done. If a smaller figure is wanted, measure off on A D, or A B C, and square over.

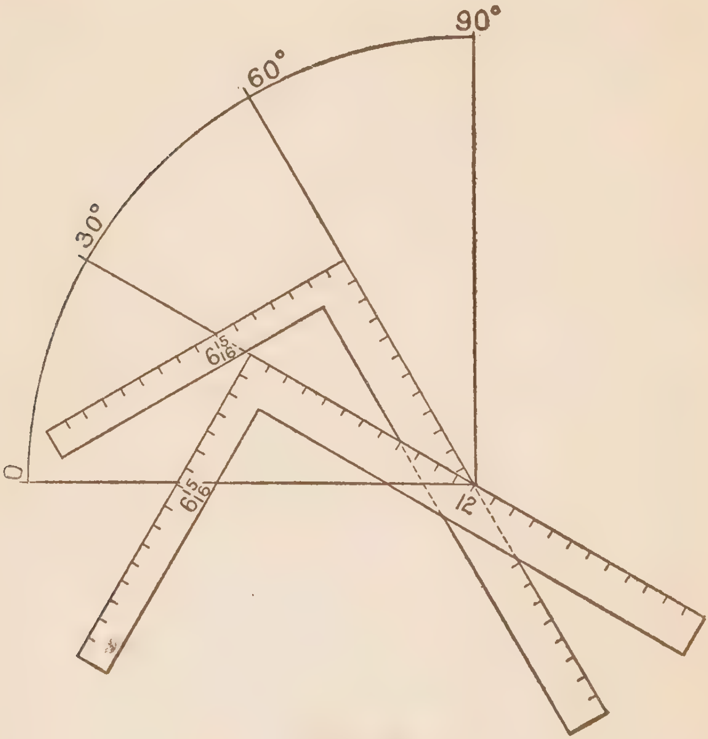


FIG. 158

In Fig. 158 we show a quarter of a circle trisected or formed into angles of 30, 60 and 90 degrees: 12 and 6 and 15-16 by the square will give 30 degrees and the remainder will be 60 degrees. These are things to remember, as the car-

penter and joiner will find them very useful in his everyday work.

Other Methods of Obtaining Circumference of Circles of Given Diameters.—Fig. 159 shows how the circumference of a circle may be obtained by the square, the diameter being given. The solution of this problem by use of the steel square has been attempted by a number of writers on

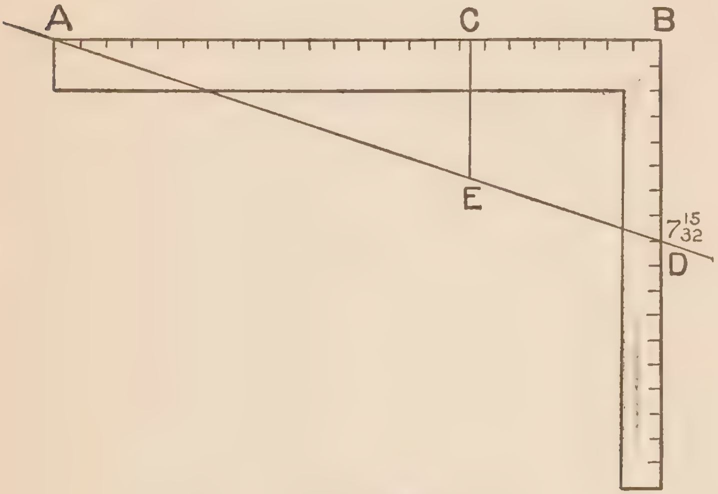


FIG. 159

carpentry. It is not claimed that absolute correctness is obtained in the following way, but it is claimed for this method that it is the nearest approach to correctness yet made by using the steel square. The method is not new, it having been employed for a number of years. Let A D represent the straight edge of a board, say 10 inches, or 12 inches wide; place the end of the blade of

square at A, and let D on tongue be 7 and 15-32 inches. Take three diameters from A to C, and square down a line from C, cutting A D at E; then A E equals the circumference. A circle whose diameter is eight inches would have a circumference equal to the line from A to D by this rule. It will be seen by this that any right angle whose base is 24, and having an altitude of 7 and 15-32, forms a constant by which any circumference may be obtained by spacing three times the diameter on the line A B, and squaring down as at C, the hypothenuse being the required answer. The line A B may be continued indefinitely, being careful to retain the proper angle as shown in diagram.

Fig. 160 shows a method by which the circumference of a circle may be obtained from the diameter. This will be found very convenient in almost all the trades; particularly is it so for sheet-metal workers, carpenters, plasterers and coopers.

Describe a circle in some proportion to the actual work, say one inch to the foot; then apply the heel of the square at the center of the circle, as at A, then project the lines A B and A C as shown. Now connect the points where the radial lines touch the circle by the line B C, and from the middle point of this line draw the line D E to the circumference. To obtain the circumference of the circle, add to three times the diameter the distance D E, which will give the desired result practically correct.

In Fig. 161 we give a practical illustration. Suppose we have a circular tank, or a sheet-metal vessel of any sort that requires to be twenty feet in diameter. Draw a circle twenty inches in diameter. This is one inch to the foot; place the

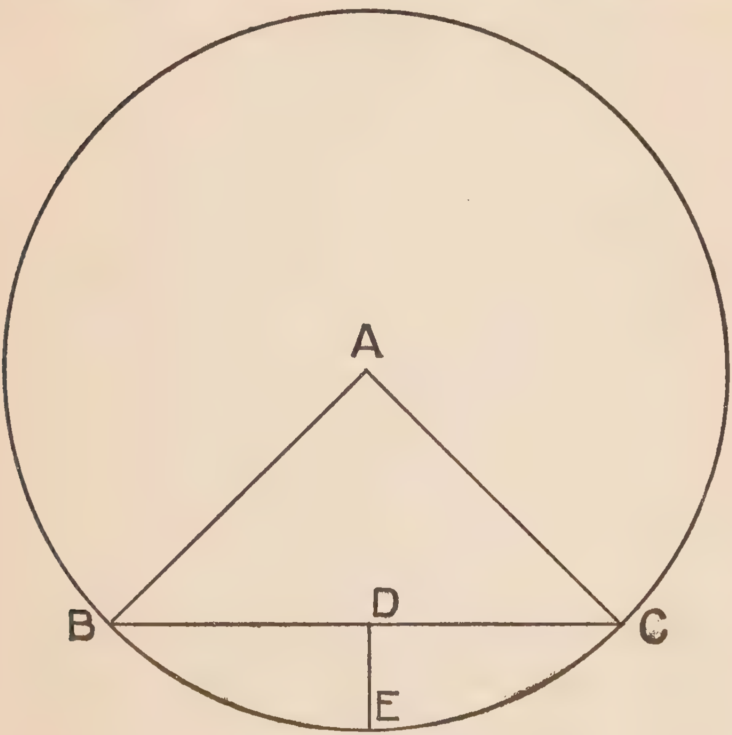


FIG. 160

square with the heel on the center as at A, draw lines along side blade and tongue as shown, cutting circumference, then at the junction of these lines draw a line same as B C in Fig. 160, then draw the short line from the center of the line B C, Fig.

160 and you have the circumference near enough for all practical purposes. It will be seen at once how useful this method may prove to the mechanic and how easily applied. For getting the length of hoops, or the number and breadth of staves

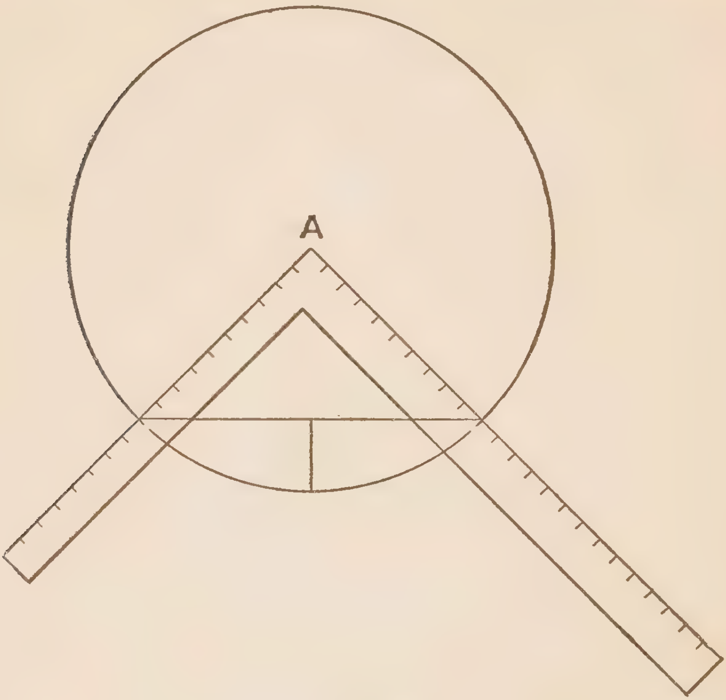


FIG. 161

for a circular tub, it will prove quite a useful method.

To Describe a Circle with the Aid of the Steel Square.—This may be accurately done provided the diameter of the circle does not exceed the length of the shorter member of the square.

In Fig. 162 let A B be the desired diameter and at these points drive small brads. Then place the inner edges of the square as shown touching the brads and with a pencil at the angle of the square as at C move the square, keeping it close up to the brads, and it will have made a true

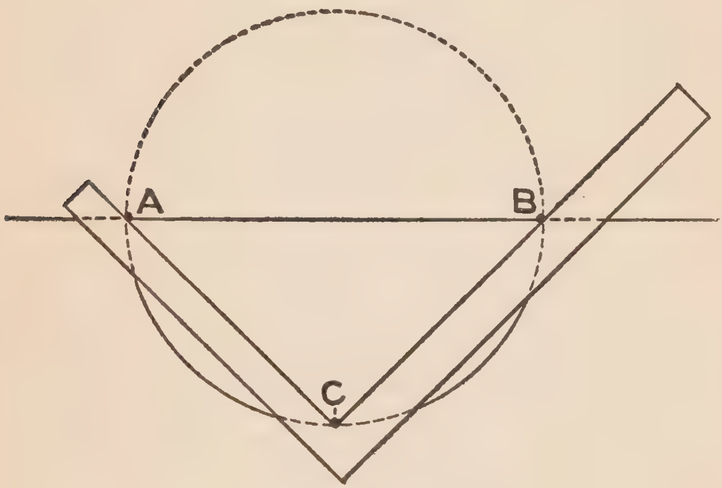


FIG. 162

semi-circle. Reverse the square and repeat the operation and the true circle will be complete.

How Square May be used to Form Ellipses.—In Fig. 163 we show how the square can be used, in lieu of the trammel, for the production of ellipses. Here the square, E D F, is used to form the elliptical quadrant, A B, instead of the cross of the trammel; h l k may be simply pins, which can be pressed against the sides of the square while the tracer is moved. In this case the ad-

justment is obtained by making the distance, hl, equal to the semi-axis minor, and the distance l k, equal to the semi-axis major.

To Describe a Parabola.—Fig. 164 shows a method of describing a parabola by means of a

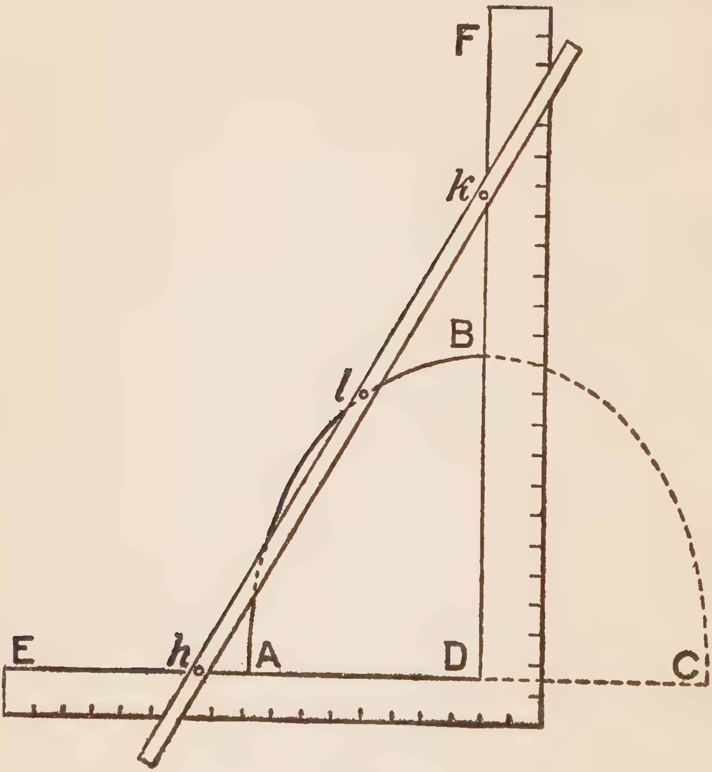


FIG. 163

straight rule and a square, its double ordinate and abscissa being given. Let A C be the double ordinate, B the abscissa. Bisect DC in F; join BF, and draw F E at right angles to B F, cutting the axis

B D produced in E. From B set off B G equal to D E, and G will be the focus of the parabola. Make B L equal to B G, and lay the rule on straight edge H K on L, parallel to A C. Make A P equal B G. Take a string P F G, equal in length to L E; attach one of its ends to a pin, or other

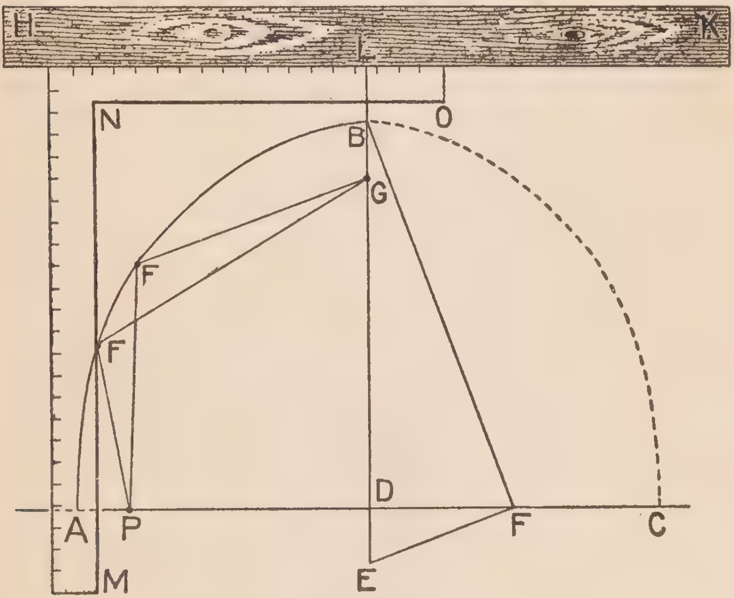


FIG. 164

fastening, at G, and its other end at P. If now the square be slid along the straight-edge, and the string be pressed against its edge M N, a pencil placed in the bight at F will describe the curve.

To Determine What Weight is Required to Balance Lever.—The two arms of a horizontal lever are respectively 9 inches and 13 inches in

length from the suspending point; and a weight of 10 lbs. is suspended from the shorter arm, and it is required to know what weight will be required to suspend on the long arm to make it balance. Set a bevel on the blade of the square at 13 inches and the other end of the bevel on the 9 inch mark on tongue of square, then slide the bevel from 13 inches to 10 on the blade of square, and the answer will be found on the tongue of the square. It is easy to see how this rule can be reversed so that a weight required for the shorter arm can be found.

To Make a Semicircular Groove.—Sometimes the workman may have a semicircular groove to make, either as a pattern for casting or as a moulding of some sort. Now it is a well known geometrical fact that the angle within a semicircular circumference is a right angle; this being admitted, it may be taken advantage of in making such hollow forms as we have mentioned, and which we illustrate by the Fig. 165. The curve or semicircle may be worked out by a plane or other instrument, and to prove the correctness of the work, the steel square may be applied as shown. If the square touches at only two points, then the groove is not deep enough, or else it is too deep, in which case the operator must remove more stuff from the groove, or from the flat surface of the work, if permissible. By giving the square an oscillating motion, so as to make the corner sweep the entire surface of the curve, the accuracy of the work may be ascertained whenever the square is applied.

In this instance the square may be used as a templet, and the advantages of it in such cases are that it may be used in any sized semicircular groove, thus saving a multiplication of templets. This principle may be extended further, as it is equally applicable to a hollow hemisphere as to a hollow semicylinder, which makes the knowledge of this fact of great value to wood or metal

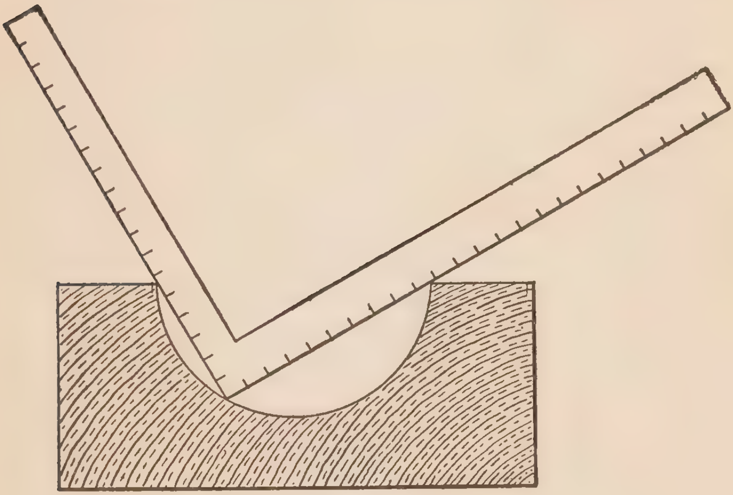


FIG. 165

turners, as it can be easily seen that a hollow hemisphere must be nearly true if the cutter or heel of the square touches every point, and the blade and tongue lie on the exact diameter. The operator can apply this principle to many cases, if he is at all ingenious.

To Cut for Pitched Covers.—Here is a little problem that may come into use on many occas-

ions: Suppose we want to cut a piece of sheet metal, paper or thin wood so that it may form a cone, or a cover for a vessel of some sort; say the pitch or height at center is to be four inches, and the diameter of the base sixteen inches. Lay off the pitch on the tongue and half the diameter

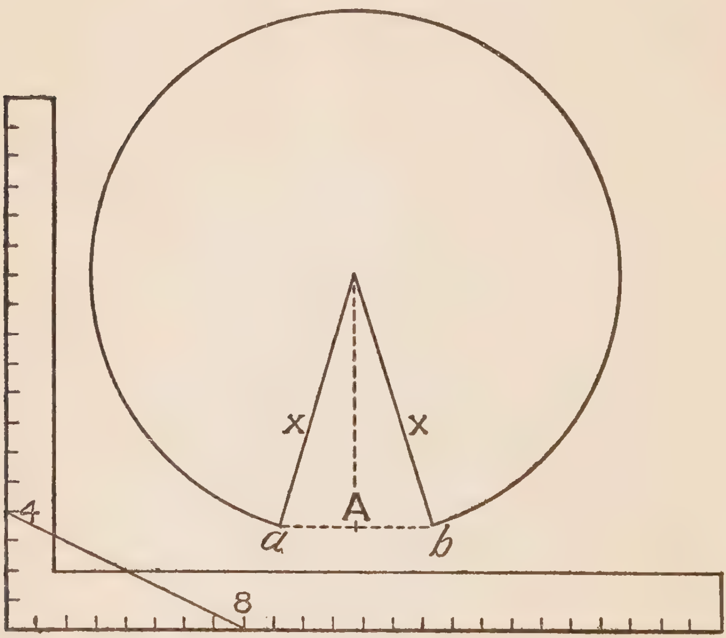


FIG. 166

on the blade. The diagonal, from 4 to 8, as shown in Fig. 166, gives half the diameter of the circle, to which set your compasses. Describe a circle as at Fig. 166, draw a line from the center as shown, square off from A, on each side three-tenths of the radius, ending at a, and b. The

gore left requires to be removed, then when the edges X X are brought together the cone is complete.

The Circumference of an Ellipse or Oval is found by setting 5 and five-eights on the tongue and $8\frac{3}{4}$ inches on the blade; then set the bevel to the sum of the longest and shortest diameters on the tongue, and the blade gives the answer.

The Sectional Part of a Circular Frame or Wheel can easily be found by the aid of the square as follows: Draw line A, Fig. 167, and on it place the tongue of the square as shown, letting the 12 inch mark be the starting point.

Now suppose we wish to make a frame with eight equal parts. Draw a line from 12 on the tongue, passing at 12 on the blade, and on this lay off the desired radius, and swing down to A. The space from A to C will be the desired part. If twelve parts are wanted then draw the line passing at 6 and 15-16 on the blade. The part from A to B being that proportion.

If one-half the parts mentioned above are wanted then these parts may be doubled, or found as shown by the dotted lines below A. Great care must be exercised in laying out the diagram, the least variation of which will be multiplied by the number of parts used.

When making frames of very large diameters, it is better to increase the scale by raising the figures given by doubling, trebling, etc.

To Lay off a Miter or Equal Joint.—In our experience, we have frequently been asked how

a miter, or equal joint, could be laid off by using the square.

The matter is simple, but the many inquiries that have been received induce us to give a few

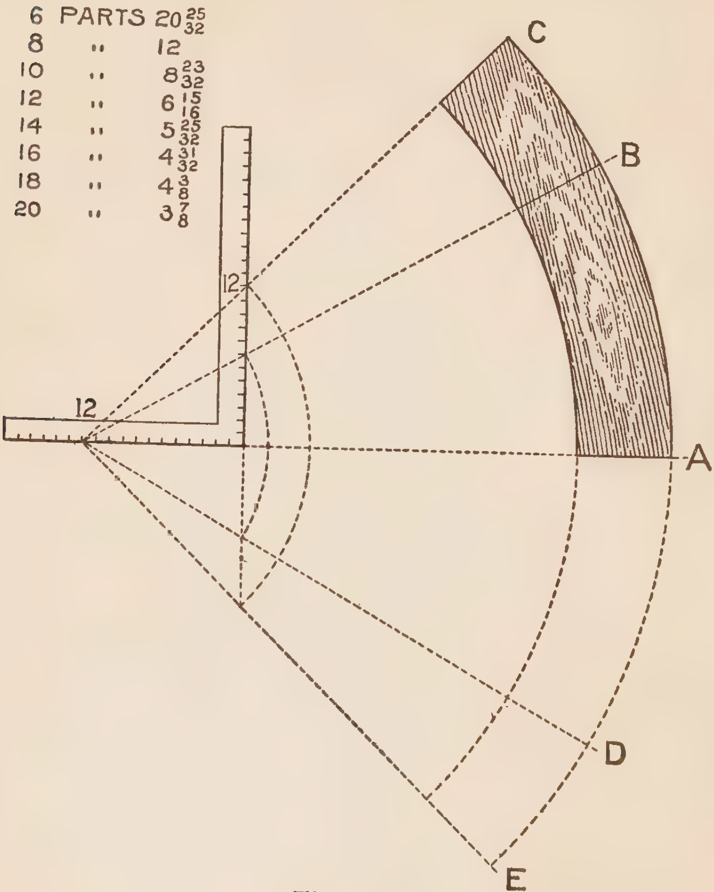


FIG. 167

examples of the manner in which advanced workmen generally accomplish this end. Let Fig. 168

represent an oblique angle formed by two parallel boards. To obtain the joint A, space off equal

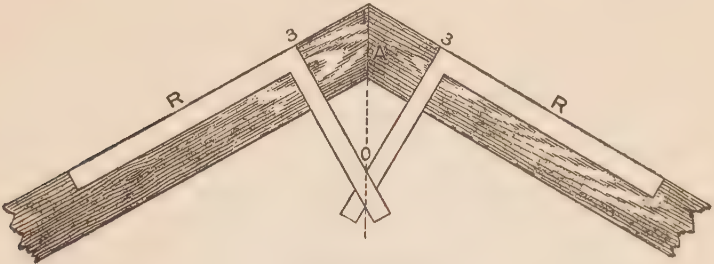


FIG. 168

distances from the point 1 to 3, 3, then square over from the lines, R, R, keeping the heel of the square at the points 3, 3. At the junction of the lines

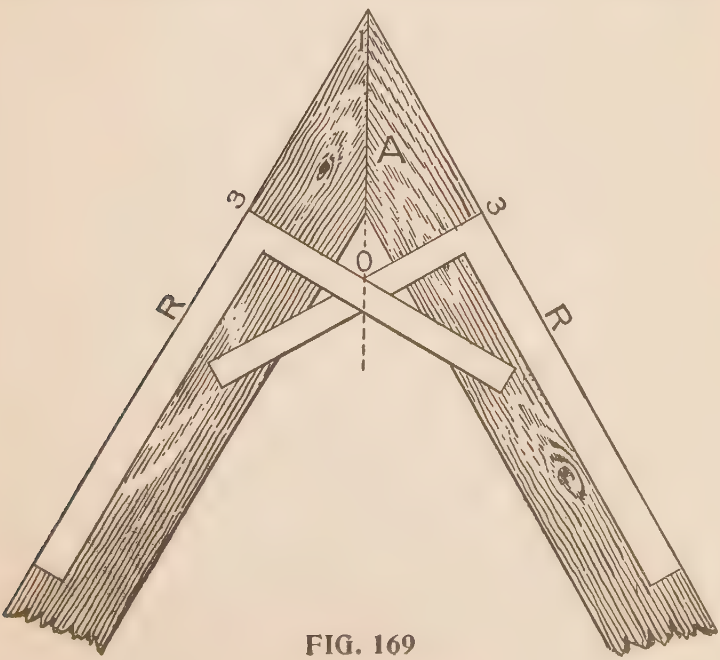


FIG. 169

formed by the tongues of the squares at O will be the point to take on the tongue, and $\frac{1}{3}$ on the blade. The latter will give the joint line, A, as defined.

To Find the Line of Juncture for an Acute Angle, we proceed as follows: Fig. 169 represents two parallel boards; 1 the extreme angle, 3, 3 equal distances from the angle 1 and are the points where the heel of the square must rest to form the lines O, 3; O shows the junction of the lines formed by the tongues of the squares, and then proceed as in the previous example.

It will be seen, by these two examples, that the bevel of a junction at any angle may be obtained by this method.

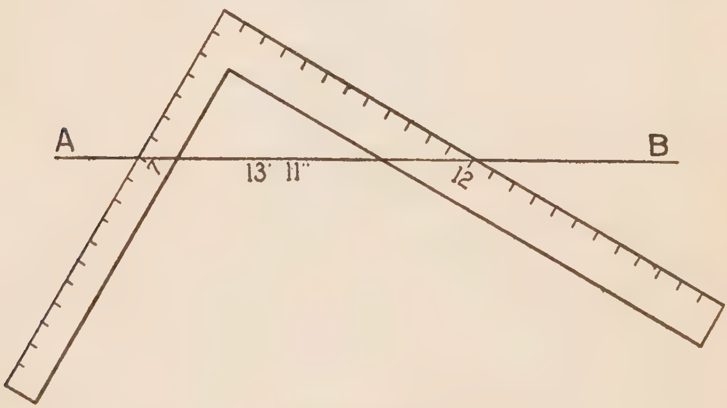


FIG. 170

To Find the Length of Braces and Other Timbers.—Sometimes, when estimating on work, it becomes necessary to get the length of braces and other timbers, that would require considerable fig-

uring to obtain if the usual method of finding the length of the third side of a right angled triangle were adopted. The square, at this juncture, may be made use of with advantage, where the length of the lines wanted is within the range of the instrument, and almost any dimensions may be manipulated, by making the subdivisions of the inch represent inches, feet or yards. Suppose we want to get the length of a brace with unequal run of 7 and 12 feet respectively. Lay the two-foot rule across the square, putting the end on 7 on the tongue, and cutting the 12-inch line on the blade; then, as shown in Fig. 170, we will have on the side of the rule A B, 13 feet, 11 inches, or say 14 feet, which is near enough for the estimator's purpose, and if required for working purposes, the exact length and bevels may be obtained by careful measurement.

To Produce an Octagon.—Fig. 171 shows how an octagon can be produced by the aid of a steel square. Prick off the distance A O equal to half the distance of the square; mark this distance on the blade of the square from B to O, place the square on the diagonal, as shown, and square over each way. Do the same at every angle, and the octagon is complete.

To obtain the same figure with the compasses, proceed as follows: Take half the diagonals on the compasses, make a little over a quarter sweep from C, and at the intersection at D and E, then D-D or E-E form one side of an octagonal figure.

Again: Take a piece of timber twelve inches square, as in Fig. 172; take twelve inches on the blade and tongue from A to B, and A to C, mark at the point A, operate similarly on the opposite edge, and the marked points will be guides for

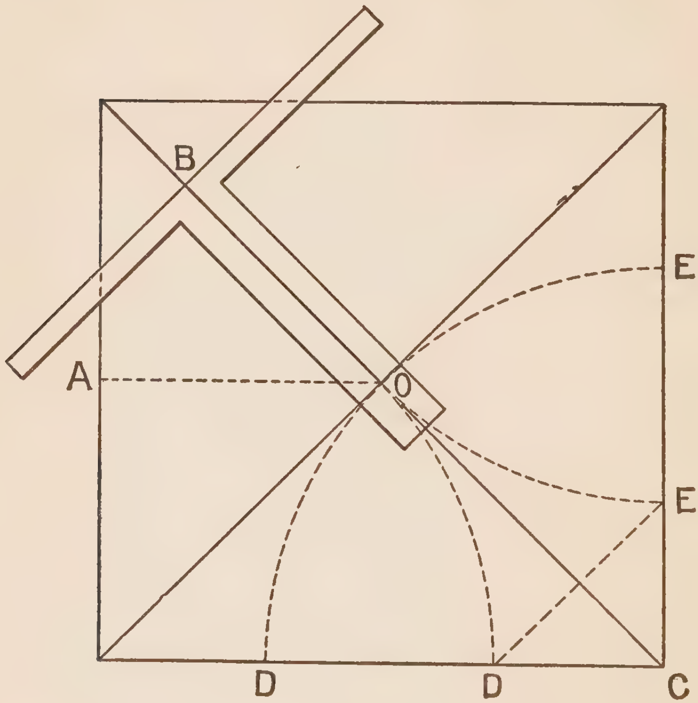


FIG. 171

gauge-lines for the angles forming an octagon. The remaining three sides of the timber can be treated in the same manner.

These points can be found with the carpenter's rule as follows: Lay the rule on the timber, partly

opened, as shown in the cut, prick off at the figures 7 and 17 as at A and B, and these points will be the guides for the gauge lines. The same points

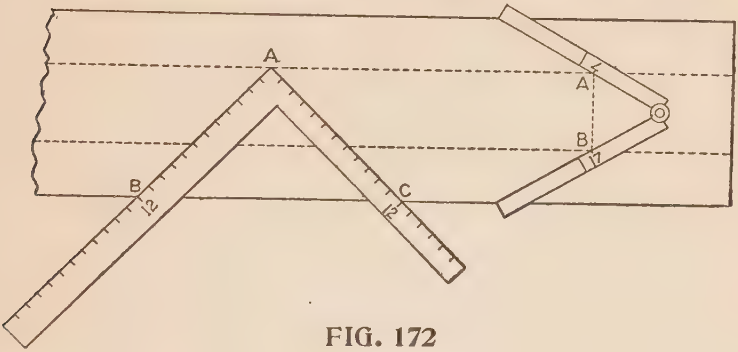


FIG. 172

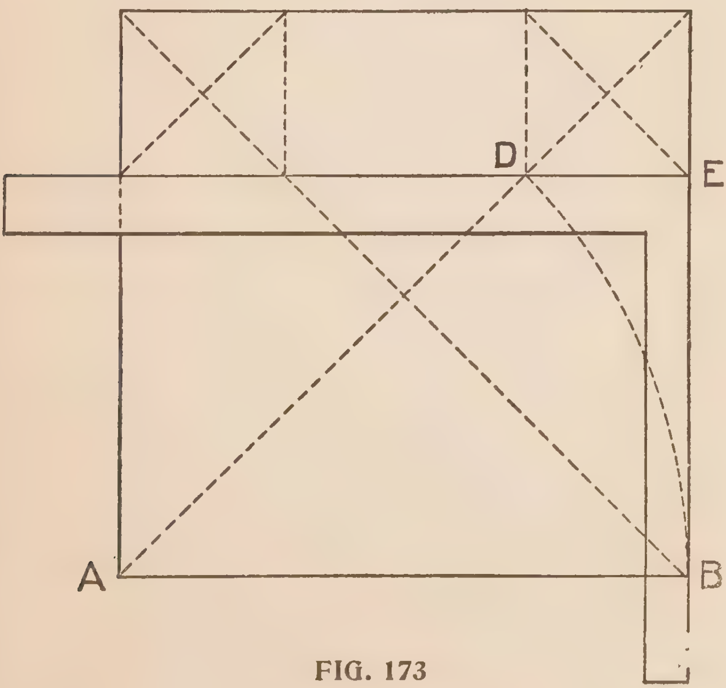


FIG. 173

can be found by laying the square diagonally across the timber and pricking off 7 and 17.

To Make a Moulder's Flask Octagonal, proceed as follows: The flask to be four feet across. Multiply 4x5 (as an octagon is always nearly as 5 to 12), which gives 20; divide by 12, which gives

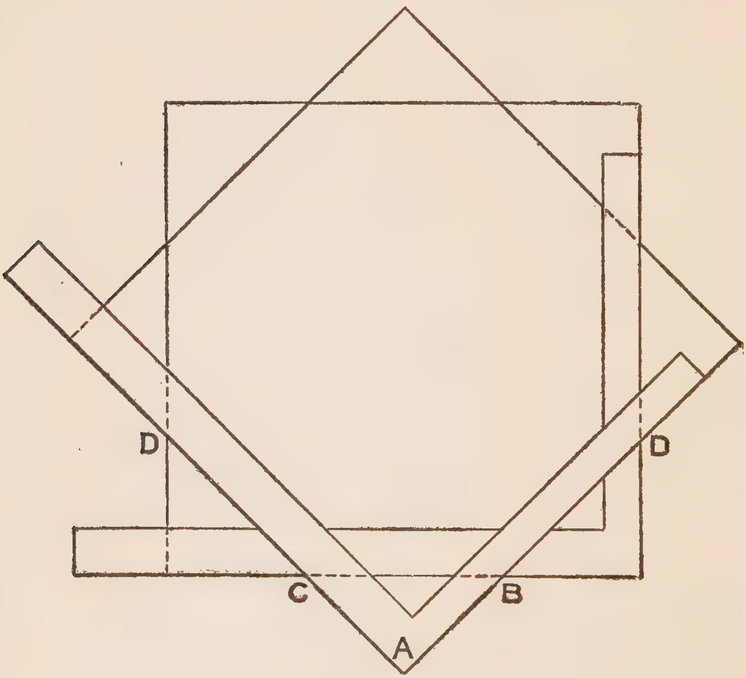


FIG. 174

1 and two-thirds feet, cut miter to suit this measurement, nail into corners of square box, and you have an octagon flask at once.

Another method of constructing an octagon is shown in Fig. 173.

Take the side as a b for a radius, describe an arc cutting the diagonal at d; square over from d to e, and the point e will then be the gauge-guide for all the sides.

Another method (Fig. 174), is to draw a straight line, c b, any length of desired side; then let a b and a c be corresponding lengths on the blade and

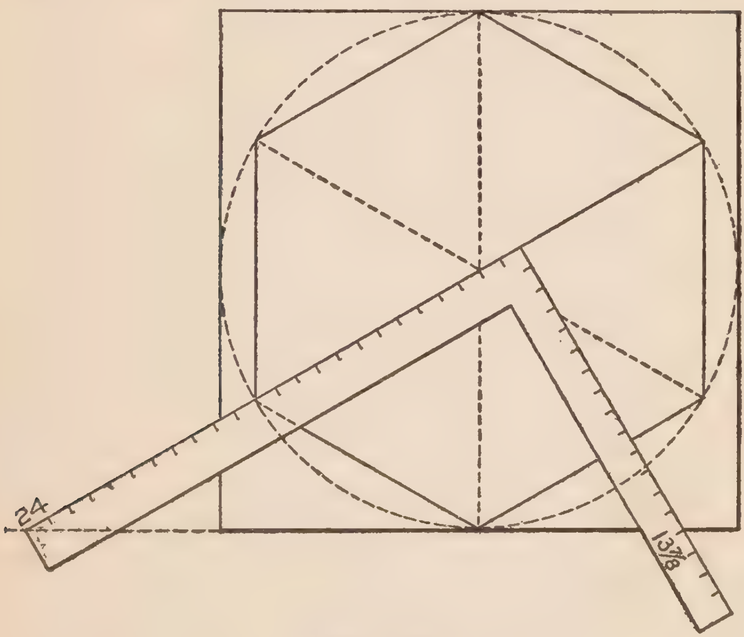


FIG. 175

tongue of the square, mark along either and move the square and mark also. Now use the square the same as before, and the marks d c and b d will equal c b.

To Make a Hexagon, Fig. 175, take 13 and $\frac{7}{8}$ inches on the tongue and 24 inches on the blade,

and apply as shown on a base line which forms a square around the figure.

Construction of a Pentagon or Five-sided Figure.—There are several methods of forming this figure, but we prefer the following: On a given line let A B, Fig. 176, be the length of one side;

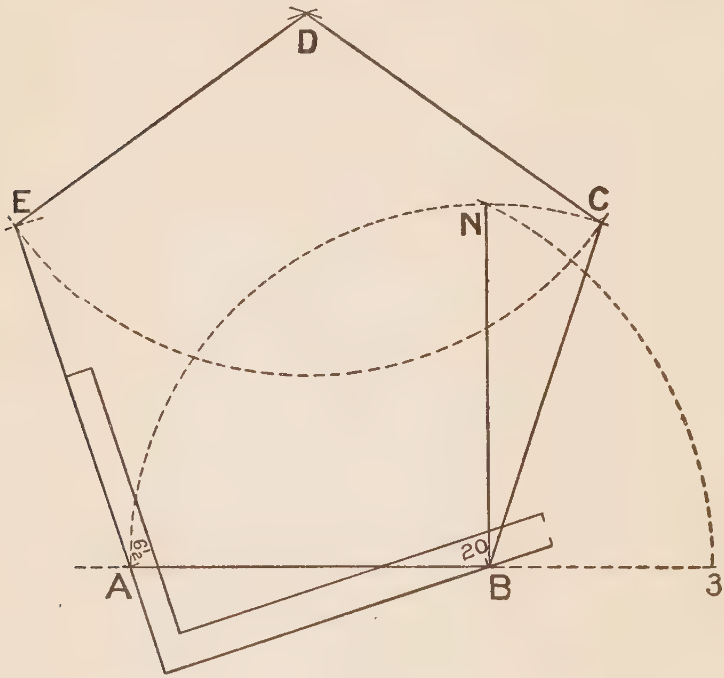


FIG. 176

divide this into two equal parts, marking it as at 2. From B square up a line, and make B N equal to A B, then with 2 as a center and 2N as radius, describe the arc, cutting the line A B at 3. Now take A3 for radius, and from A and B as centers

make the intersections at D; then from D, with a radius equal to A B, describe an arc as shown; then using A and B for centers, intersect the arc in E and C; connect these pionts together with straight lines, and the pentagon is complete.

This is a scientific way of forming this figure, but it may be obtained much easier by the square.

It may be necessary to explain that in regular equal-sided polygons the angles are equal, so any side of a regular polygon may be used for a base line. Let this fact be remembered, as it is important the student should keep it in mind when dealing with any problem connected with polygons, where the steel square is used: By careful examination of Fig. 176 it will be seen that the outer edge of the tongue of the square is in line with one side, A E, of the pentagon, measuring down below the base line, A B, six and one-half inches; then the 20 inch mark on the outer edge of the square will also touch the base line, A B, This position of the square then gives the exact inclination of the side of the pentagon with the base. Now if we reverse the square and place the 6½ inch mark at B, and the 20 inch mark on the line A B, we give three sides of the figure. Now make the distance from A to E the same as A B, and we have the length of that side. Perform the same operation with B C. Then using A E and B C as base lines, we can form the complete figure. This shows how any pentagon having equal sides can be formed with the square.

We wish to recall again that 6½ inches on the

tongue and 20 inches on the blade give the proper angle for forming pentagons.

To Obtain a Heptagon.—Fig. 177 shows a heptagon, or seven-sided figure, and the manner

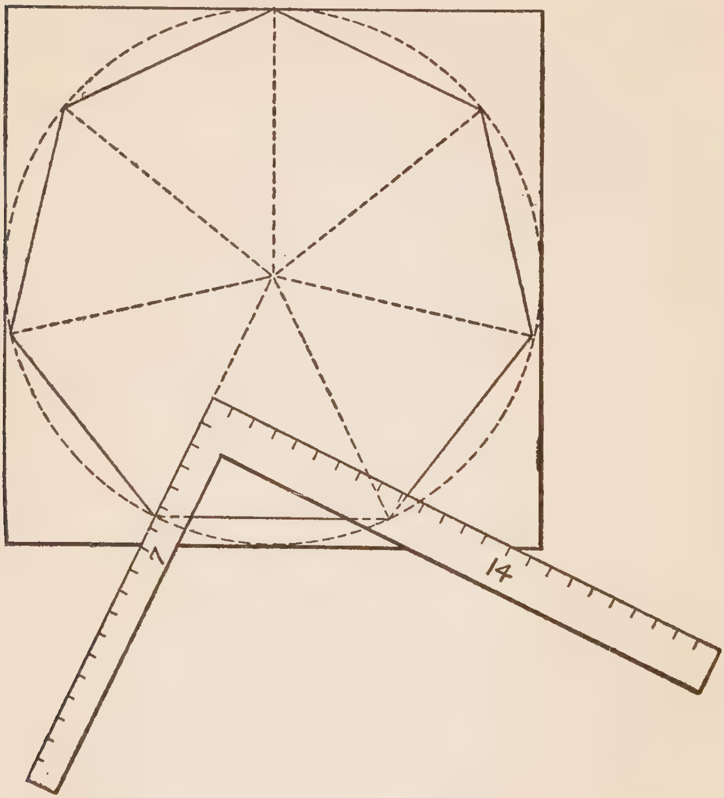


FIG. 177

in which it is obtained. To get the angle as shown, form a square in accordance with dimensions required; then inscribe a circle as shown; then place the square as represented, using the base line of

the outside figure having the tongue running in a line with the center, keeping the 7 inch mark on the base line; then on the blade the 14 inch mark will be over the base line. Hence, 7 inches on the tongue and 14 inches on the blade gives the figures for finding the lines for a heptagon.

To Lay Off an Octagon in a Square.—In Fig. 178, measure off the side of the square on its diag-

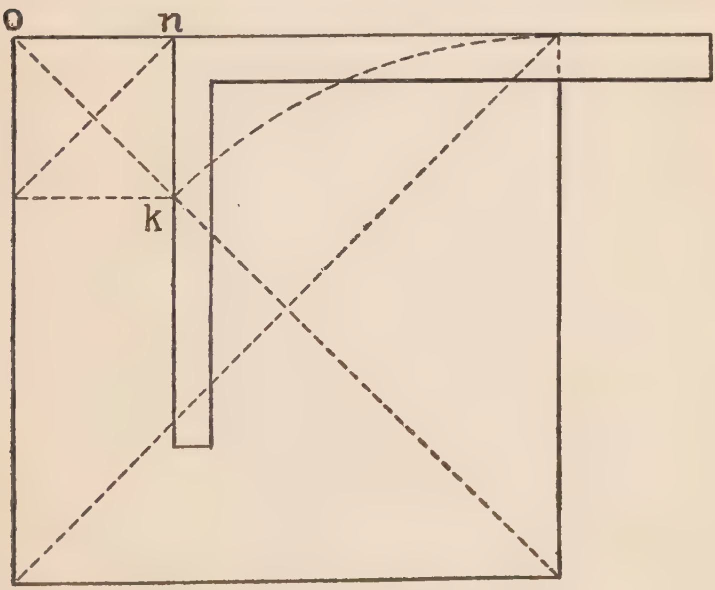


FIG. 178

onal k. Square from a side to the point thus found on the diagonal, and n o is the distance to be gauged from each corner, to mark the corners of the octagon.

When the Side of the Octagon is Given to Find the Square Width.—Suppose the side of the octagon

is to be 16 feet; take half this or 96 inches for the square, 16 inches on both tongue and blade taken 6 times, giving 11 feet $3\frac{3}{4}$ inches, which, being doubled and added to the side of the octagon, gives the square width.

To Obtain Correct Shape of a Veneer.—Fig. 179 shows a method of obtaining the correct shape of a

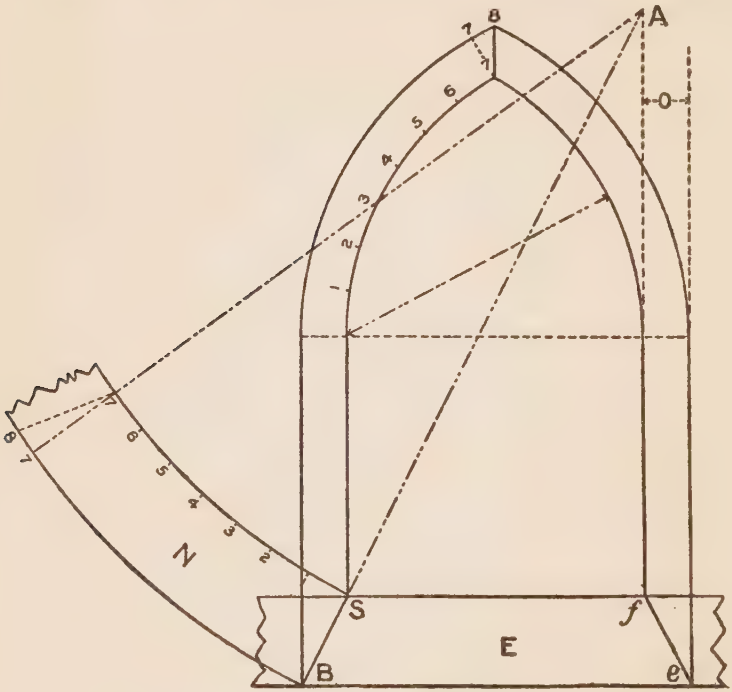


FIG. 179

veneer for covering the splayed head of a gothic jamb. E shows the horizontal sill of the splay, fA the line of the inside of jamb, o the difference between front and back edges of jamb, BA the

line of splay. At the point of junction of the lines BA, fA, set one point of the compasses, and with the radius AB draw the outside curve of N; then with the radius AS draw the inside curve, and N will be the veneer required. This will give the required shape for either side of the head. Its length may be found by spacing off the head as shown by 1,2,3, etc., and space off like amounts on the inner edge of piece N.

Proportional Scales may be readily enlarged by the use of the Steel Square as shown in Fig.180.

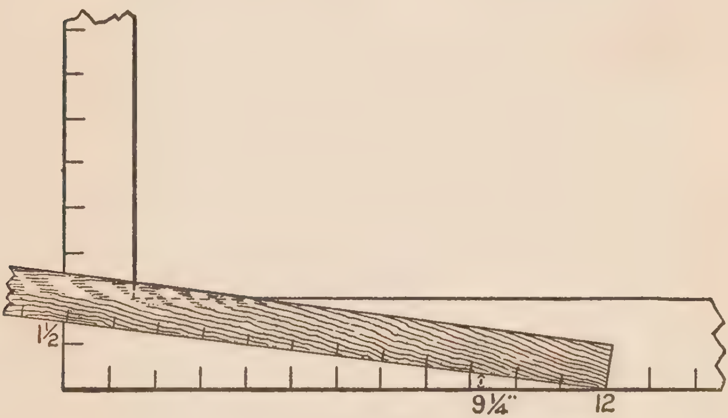


FIG. 180

To Reduce from One Scale to Another.—If a person is drawing a machine on a scale of 1½ inches to the foot, he may simply lay a common rule over the square, touching the 12-inch mark on the blade, and the 1½-inch mark on the tongue; he then possesses a contrivance by which he may easily reduce from one scale to the other. For

instance, if a piece of stick $2\frac{3}{4}$ inches square is to go into the construction, the draughtsman finds the $9\frac{1}{4}$-inch mark on the blade, that is $2\frac{3}{4}$ inches back from the 12-inch mark, and measures square out to the rule. This distance is the reduced section of the stick. A straight mark, drawn on a table or a drawing board, serves as well as a rule.

Part II

POLYGONS AND MITERS. Polygons inscribed in circles — Foundation of miters — Fractional value of decimals — Polygonal figures — Side of polygon being known to find length of perpendicular — To divide a circle into a given number of parts — To measure inaccessible distances by aid of the square — To find the distance across a body of water — To find the height of a tree — To find a required opening in a pitched roof.

Polygons Inscribed in Circles.—In the following table, set the bevel to the pair of numbers under the ploygon to be inscribed.

No. of sides	3	4	5	6	7	8	9	10	11	12
Radius . . .	56	70	74	Side equal to radius	60	98	22	89	80	85
Side	97	99	87		52	75	15	55	45	44

If we require the radius of a circle which will circumscribe an octagon 8 inches on a side, we refer to column 8, take 98 parts on the blade and 75 on tongue, and tighten the bevel. As the side of a hexagon equals the radius of its circle, the side of an octagon must be less than the radius; hence we shift to 8 inches, that end of the bevel blade which gives the lesser number, in this case, on the tongue of the square, as the 75 parts to which the bevel was set are less than the 98. The required radius is then indicated on the blade.

We will now explain the figures used in stepping round a circle forming inscribed polygons from three to twelve sides: Set bevel or fence to 12 on blade, and the number opposite each poly-

gon on tongue; move to diameter of circle; answer of the side of polygon on tongue.

NAMES.	NO. OF SIDES.	GAUGE POINTS.
Triangle	3	10.40
Square..........	4	8.49
Pentagon	5	7.05
Hexagon	6	6.00
Heptagon	7	5.21
Octagon	8	4.60
Nonagon	9	4.11
Decagon.........	10	3.71
Undecagon	11	3.39
Dodecagon	12	3.11

To Divide a Circle into a Given Number of Parts, multiply the corresponding number in column one and the product is the chord to lay off on the circumference. **The side of the polygon being known, to find the radius of a circle that will circumscribe:** Multiply the given side by the corresponding number opposite of polygon in column two.

No. of Sides	Names of Polygons	Angle	Angle of Polygon	Column 1	Column 2
3	Triangle	120	60	1.732	.5773
4	Square......	90	90	1.414	.7071
5	Pentagon ...	72	108	1.175	.8510
6	Hexagon	60	120	Radius	Side
7	Heptagon ...	$51\frac{3}{7}$	$128\frac{4}{7}$	.8677	1.1520
8	Octagon	45	135	.7653	1.3071
9	Nonagon	40	140	.6840	1.4863
10	Decagon.....	36	144	.6180	1.6181
11	Undecagon ..	$32\frac{8}{11}$	$147\frac{3}{11}$	.5634	1.7754
12	Dodecagon ..	30	150	.5176	1.9323

The Side of a Polygon Being Known, to Find the Length of Perpendicular.—Set bevel or fence to the tabulated numbers below. Example: The side of an octagon is 12, set bevel to 23 on tongue, $27\frac{7}{10}$ on blade. Blade gives the answer.

No. of Sides	3	4	5	6	7	8	9	10	11	12
Perpendicular	9	1	30	13	$27\frac{3}{4}$	$27\frac{7}{10}$	$50\frac{3}{4}$	$28\frac{1}{2}$	$51\frac{3}{4}$	26
Side of Polygon	$31\frac{1}{5}$	2	$35\frac{1}{4}$	15	26	23	37	$18\frac{1}{2}$	$30\frac{1}{2}$	14

Foundation of Miters.—We said that it was in the division of the circle that the whole subject of miters is founded, whether regular or irregular, and we believe there is no better way of illustrating this point than as shown in Fig. 181. If there is any one of the illustrations that we feel a little bit prouder of than the others, it would fall to this one.

In this figure are shown a number of the regular polygons. Here they are beginning with the triangle in their order up to twelve, then they skip to fifteen and they could keep on growing in number of sides until their lengths would represent only a very small fractional part of an inch. There is a whole lot of practical information that may be gathered from this illustration.

By dividing 360 (the number of degrees in a circle), by the number of sides in the desired polygon will give the angle that the miters stand with each other, but in order to obtain the angle on the steel square, it is only necessary to divide

180 by the number of the sides in the polygon and the quotient will represent the angle in degrees to use on the steel square to obtain the miter. The blade giving the cut. The figures used on the blade also give the length of the sides of the polygon when the inscribed diameter is one foot. These figures are also used for cuts in roof work.

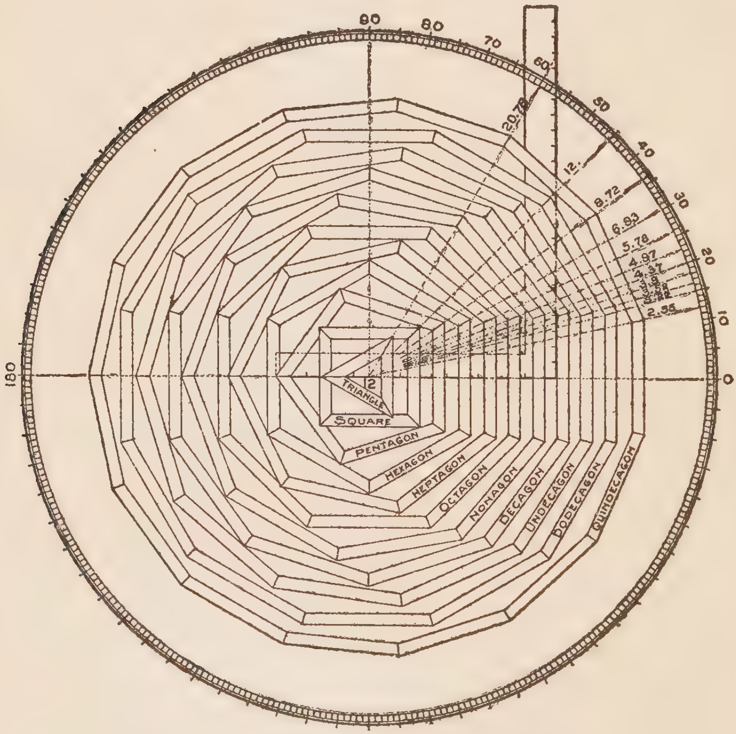


FIG. 181

Fractional Value of Decimals.—The following fractional numbers represent the value of the deci-

mal numbers shown on the degree lines and are the figures to use on the blade as follows: triangle, 20 19-24; square, 12; pentagon, 8 17-24; hexagon, 6 11-12; heptagon, 5 19-24; octagon, 4 23-24; nonagon, $4\frac{3}{8}$; decagon, 3 11-12; undecagon, $3\frac{1}{2}$; dudecagon, 3 5-24; quindecagon, 2 13-24.

These fractional numbers are to the 1-24 part of an inch and are about as near as can be had on the steel square, none of them varying over .02 of an inch. Polygons are known by the number of their sides as per the above names given in their order up to the twelve sided figures, after that, with the exception of fifteen which is called quindecagon, are known as polygons of so many sides.

In some of the encyclopedias the triangle and square are not classed with the polygons, but we see no reason why they should not be, since the rule that applies to other sided figures applies to them also.

The subject of polygons is not as well understood as it should be. It is quite a common thing to call most any kind of a corner aside from the right angle, an octagon corner, due no doubt to the fact of their little demand in practical work, for, aside from the octagon, they are but little used. However, it is well to know them, and to know one is to know them all.

Though many of the illustrations that we have given may never come up in actual practice, they show that when the principles are once undersdood the mechanic will know how to proceed

to apply the square to solve anything pertaining to angles in his line of work. However, we have a few more illustrations that we wish to present before passing them by.

In Fig. 182 is shown an example in line work.

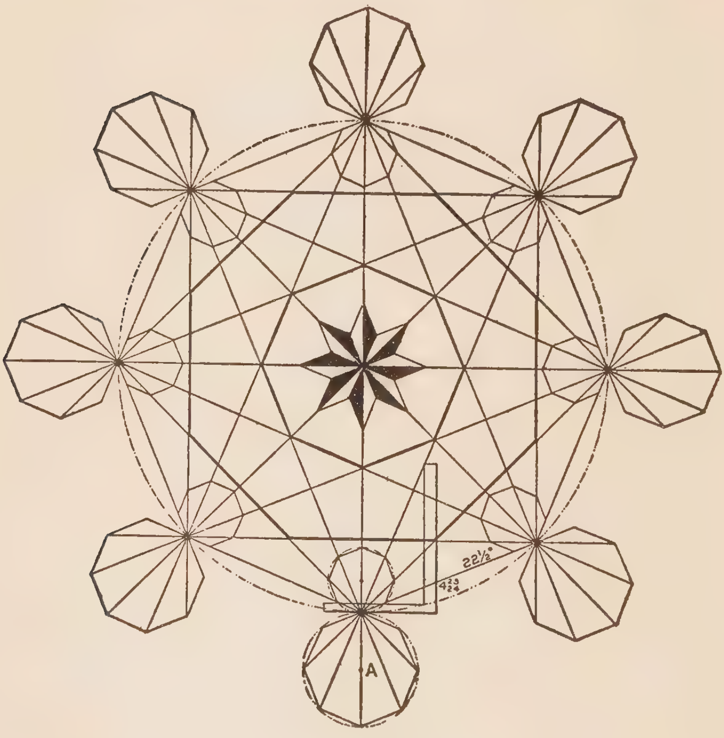


FIG. 182

The figures to use on square are those for the octagon miter and consequently the whole figure runs to the octagon. The eight lines radiating from 12 on the tongue are 22½ degrees apart, the first one intersecting the blade at 4.97, or

practically 4 23-24 inches. The center for this design according to size wanted can be taken at any desired point on the 90-degree or perpendicular line above 12 on the tongue, and where

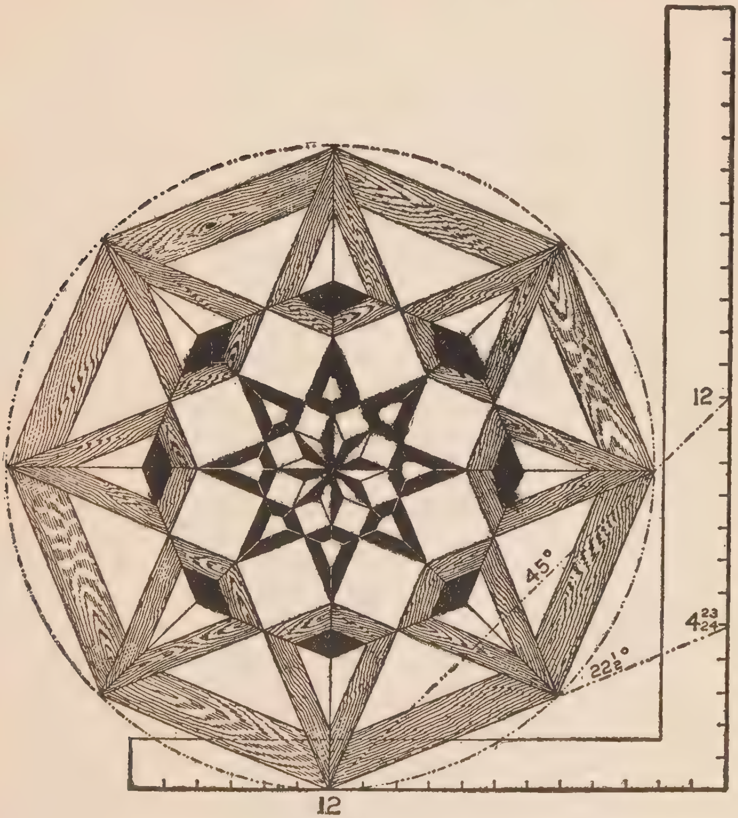


FIG. 183

the circle cuts the first degree line from the tongue determines the length of the sides of the largest octagon contained in the figure. This distance spaced off on the circle. The cross lines are then

drawn and the interior octagons will be formed as shown.

Those on the outer edge are formed by letting the cross lines extend beyond the large circle and from the center line as at A describe a circle cut-

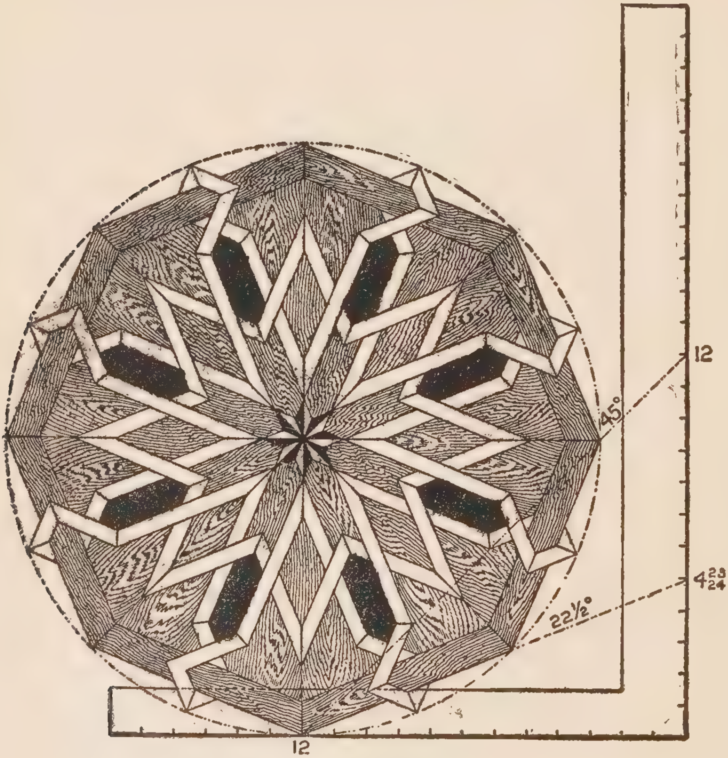


FIG. 184

ting these lines and connecting up the ends will form the octagon as shown.

In Figs. 183 and 184 are shown patterns suitable for parquet or inlaid work. All of the miters

contained in these designs can be had on the 22½ and 45-degree lines and the figures shown on the square when applied will give all of the angles as well as the miters contained in these illustrations.

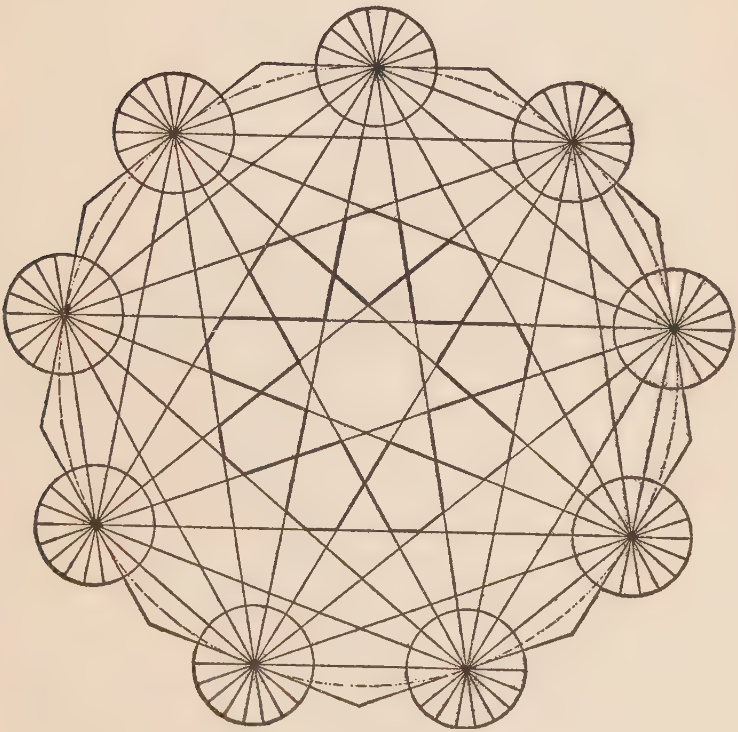


FIG. 185

In Fig. 185 is shown an example in line work for the nonagon or nine-sided polygon. We have not shown the square in connection with this illustration, but the figures to use are for the 20-

degree, because 9 is contained in 180 twenty times. The small circles are divided into eighteen parts because 20 is contained into 360 degrees eighteen times. A further explanation of this illustration would be useless, as it shows for itself.

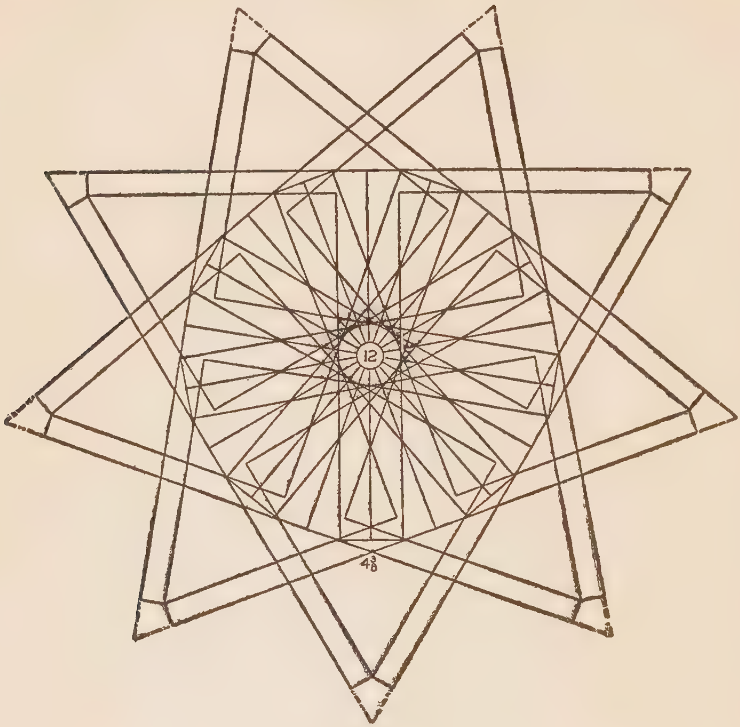


FIG. 186

In Fig. 186 is shown a very pretty design made with eighteen squares. In this the center is at 12 on the blade and the intersection at $4\frac{3}{8}$ on the tongues, which is at the 20-degree line and represents the nonagon as will be seen by the forma-

tion of the tongues at the intersections. By extending the lines from the tongues as shown by the dotted lines will form a nine pointed star.

In Fig. 187 is shown four steel squares placed in pairs as shown with lines radiating from 12 on the tongues and intersecting the blade at 2.12 ($2\frac{1}{8}$); 4.37 ($4\frac{3}{8}$); 6.93 (6 11-12); 10.06 (10 1-12);

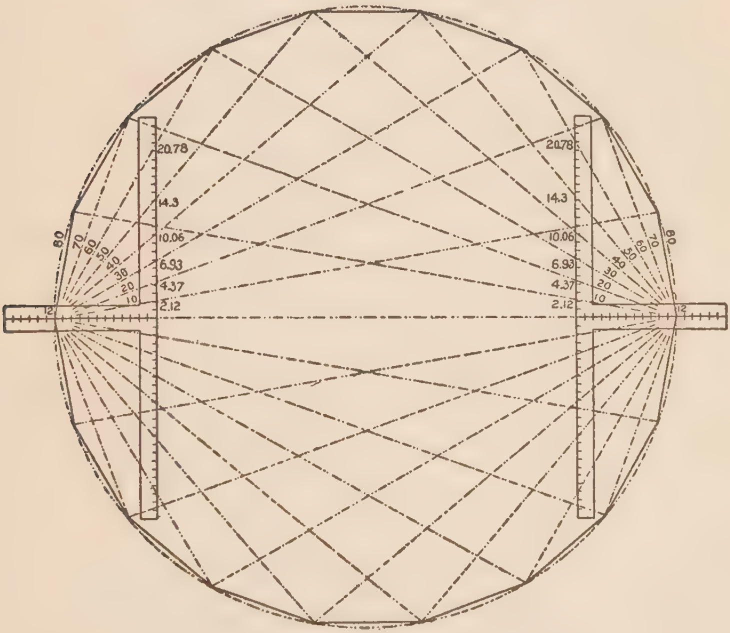


FIG. 187

14.3 (14 7-24); and 20.78 (20 19-24), which represent the degree lines as being ten degrees apart. These lines extend out to meet its complement in other words, for example, the 30 degree intersects the 60 degree line from the opposite side.

The intersections rest at 10 degrees apart on a circle with a diameter equal the distance from 12 to 12 on the tongues of the opposite squares, and by connecting the intersections forms a polygon of eighteen sides. This rule applies to any other polygon, but is not a practical way of solving problems of this kind, because there are simpler ways of arriving at the same result.

With this we close with polygonal figures, as we think we have given enough to show that all work pertaining in any way to angles may be readily obtained by the use of the common steel square.

To Measure Inaccessible Distances by Aid of the Square.—The following is from an article written by Mr. A. W. Woods, of Lincoln, Neb., and is only modified so as to place the subject before our readers in its simplest form.

Every mechanic knows that a triangle whose sides measure 6, 8 and 10 forms a true right angle and is the method commonly used in squaring foundations. But how many ever stopped to think what other figures on the square will give the same result?

By referring to trigonometry we find only three places, using 12 inches on the tongue as a basis and measuring to the inches on the blade that do not end in fractions of one inch on the hypothenuse side. They are as follows: 12 to 5 equals 13, 12 to 9 equals 15, and 12 to 16 equals 20.

Now, as we usually use a 10-foot pole to square up a foundation, we find that all of the

above contain lengths greater than our pole, so we must take their proportions. The first con-

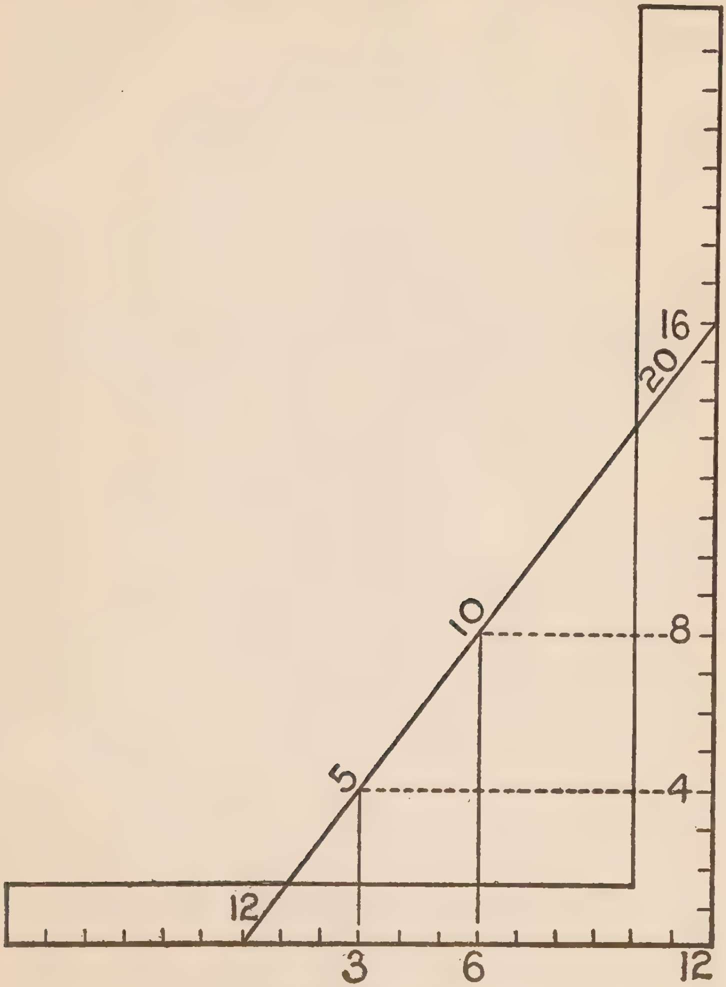


FIG. 188

tain numbers not divisible without fractions, consequently we will pass on to the next. We

find that three is the only number that will equally divide all the numbers with quotients, as follows: 4, 3 and 5, but these are too small to obtain the best results. Now let us examine 12, 16, and 20. They are even numbers, and are divisible by 2 and 4, Fig. 188. If we take half their dimensions we have 6, 8, 10.

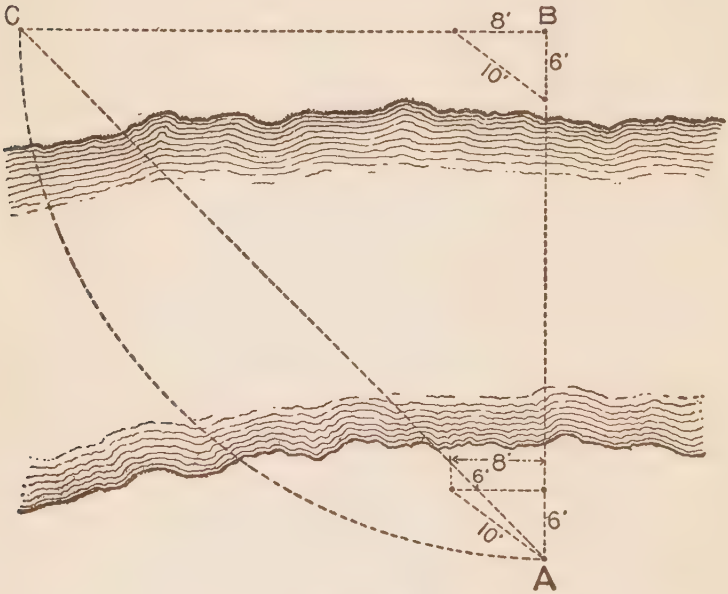


FIG. 189

These being convenient lengths and easily remembered, custom has settled on these figures.

There are other places that 6, 8, and 10 can be used to advantage.

To Find the Distance Across a Body of Water.—Suppose for some reason we want to know the distance across a body of water. We cannot wade

it, neither can we depend on a line stretched across because when it is restretched on an accessible place of measurement we have no way of determining when it is drawn to the same tension. Now, referring to Fig. 189, we want to find the distance from A to B. Lay off the angle of 6, 8, and 10, at both A and B, as shown.

Since the base and perpendicular of a right angled triangle are of equal lengths when the hypothenuse rests at 45 degrees with the former, we measure off 6 feet on the 8-foot side as shown, and this will be the point of sight from A. With a man sighting from both A and B, a third sets the stake at C. Then B C must be the same length as A B. (The arc is shown to prove the accuracy of the diagram.)

By measuring from A and B to the water's edge and subtracting the amount from B C will be given the width of the body of water.

To Find the Height of a Tree.—Fig. 190 illustrates how a tree or inaccessible height can be measured on the same principle with the aid of the steel square. Take a straight-edge and fasten at any of the equal figures on the tongue and blade. Level and set as shown, and the base will be equal to the perpendicular.

Along with the foregoing we quote from another article by Mr. Woods showing some other possibilities of the steel square.

To Find a Required Opening in a Pitched Roof.—An opening for a round pipe in a pitched roof or partition at any angle may be found as shown

in Fig. 191. Here we have a 6-inch pipe intersecting a two-thirds pitch. A line from 12 to 16 on the square represents the pitch. Now with 12 as center and with radius equal to one-half of the diameter of the pipe draw a circle and square up from the tongue to the pitch, as shown at B C.

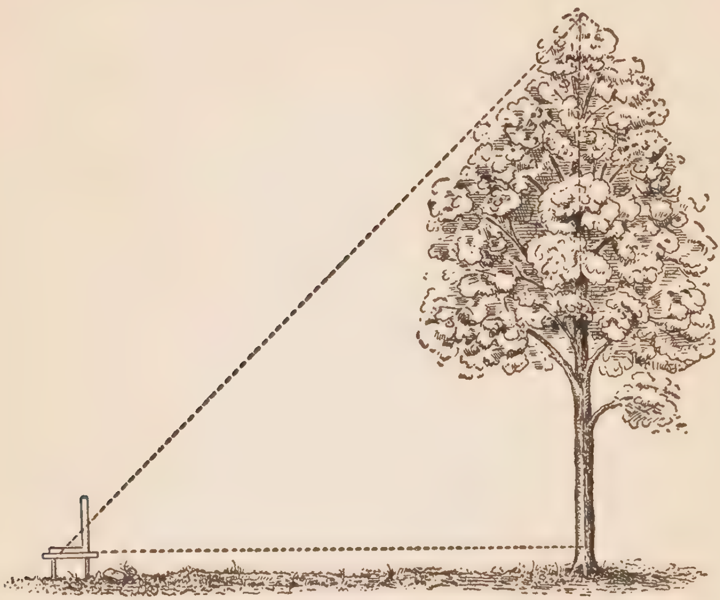


FIG. 190

Then A B represents one-half of the short diameter, and A C one-half of the long diameter. Now to make our illustration more clear we will transfer these lengths to a line at right angles with the tongue, crossing at 12.

There are several ways of finding the corresponding opening. Probably as good a method as any

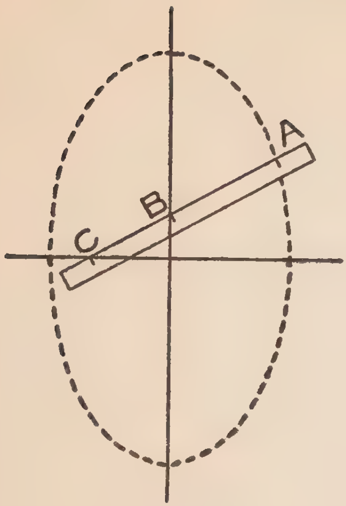


FIG. 192

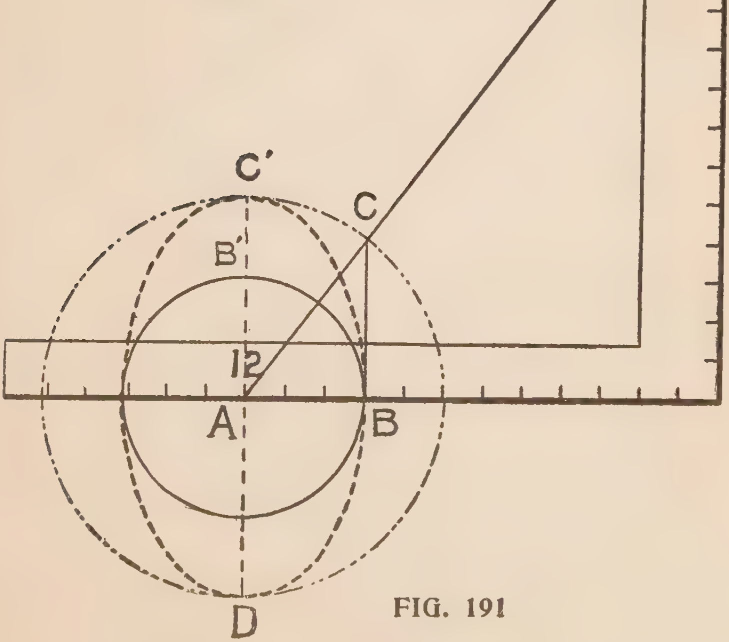


FIG. 191

is that shown in Fig. 192, which is as follows: Take a straight-edge, and on it space off A, B″, C″, as shown in Fig. 191. Now draw a line equal to the long diameter, C D, and bisect it at right angles, and to these lines apply the straight-edge, as shown in Fig. 192. Always keeping B C on the lines and marking at A will describe the required opening. The steeper the pitch the longer will be the required opening. In Fig. 193 is shownthe same formula, but with the one-third pitch

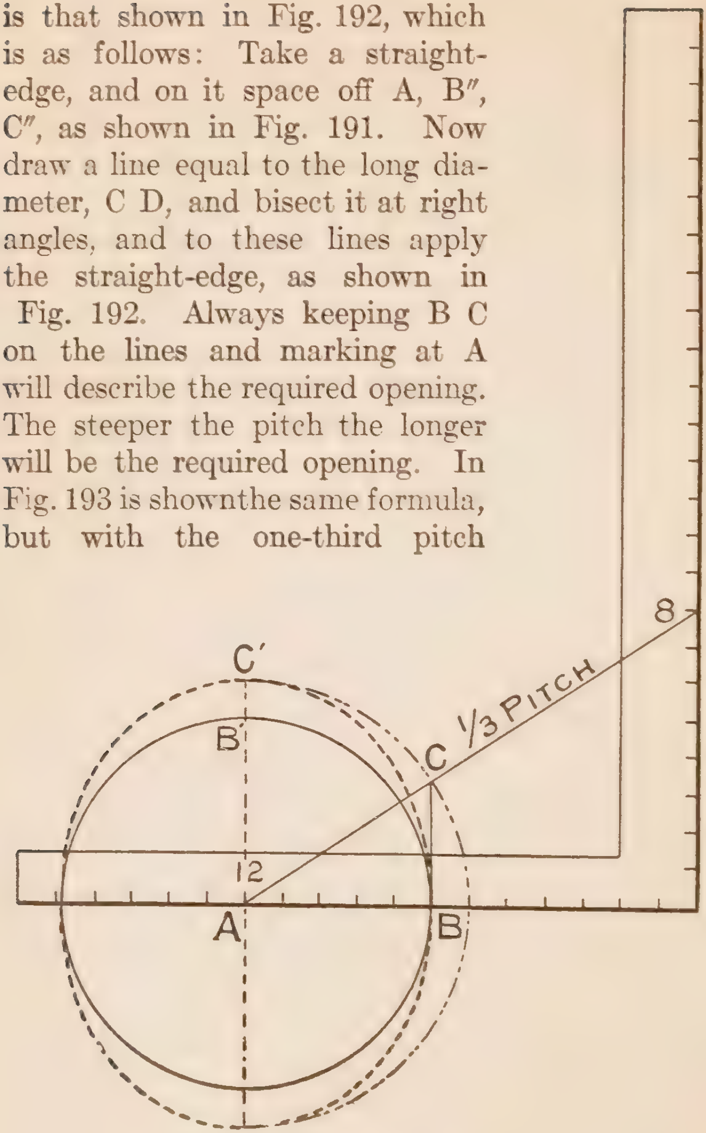


FIG. 193

and a 10-inch pipe. Fig. 194 shows another method of obtaining the opening, which is as follows: Lay off the run, rise and pitch, and with one-half the diameter of the pipe as radius, with the pencil point resting at 12, and center on run, draw a semi-circle. Divide the diameter into any number of spaces and through these run lines at

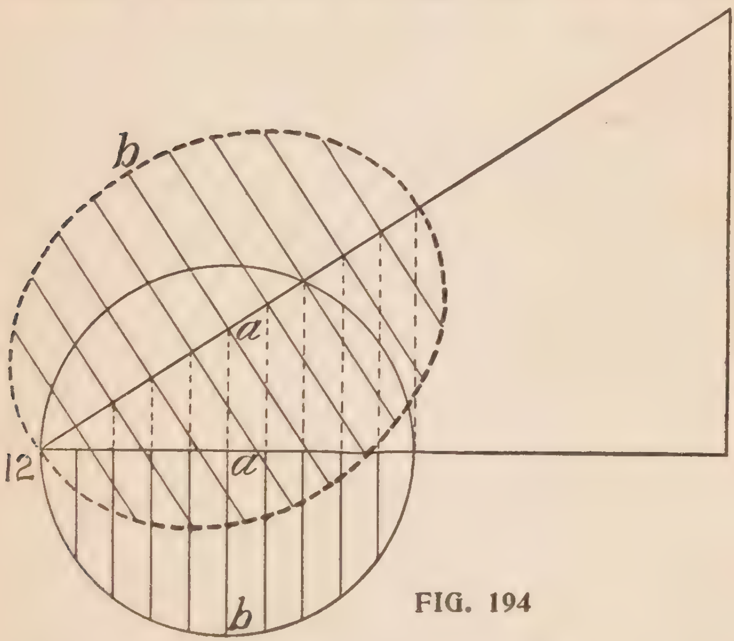


FIG. 194

right angles with the run from the circle to the pitch. At point of intersection on the pitch draw lines on either side at right angles and on this measure equal the length of the corresponding lines of the semi-circle, as at A B. Run an off-hand curve, touching these points, and you will have the required opening.

Part III

PITCHES AND ROOF FRAMING. Pitches and degrees — Pitch lines and reversed pitch — Steep pitches — What constitutes a full pitch — To cut rafters with the square — Length of jacks — Simplest way to frame a roof — Additions and porches — Cuts, lengths and bevels of rafters — Plan of roof — Unity rule — Measurement line of all jacks, hips and valleys — Backing line for octagon hip — For a triangular building — Tail end cut of hip or valley — Side cut of jacks — Octagon jacks — Plumb cut of rafters — Side cut of hip — Lengths, cuts and bevels of common rafters — Lineal board measure — Length of rafters for odd runs.

Examples and Explanations on Roof Framing.—The following examples and explanations on roof framing are simple and easily understood, and cannot fail of being valuable to the young mechanic who aspires to become an expert roof framer.

Roof framing can be done about as many different ways as there are mechanics. But undoubtedly the easiest, most rapid and most practical is framing with the square. The following cuts will illustrate several applications of the square as applied to roof framing, and all who are interested in the subject can, by giving it careful study, be able to frame any ordinary roof the mechanic comes in contact with.

Pitches and Degrees.—Fig. 195 is an illustration that could well be given much thought and study. It not only gives the most common pitches, but

also gives the degrees. Most carpenters know that half pitch is 45 degrees, yet few know third-pitch is nearly 34, and quarter-pitch about 27 degrees.

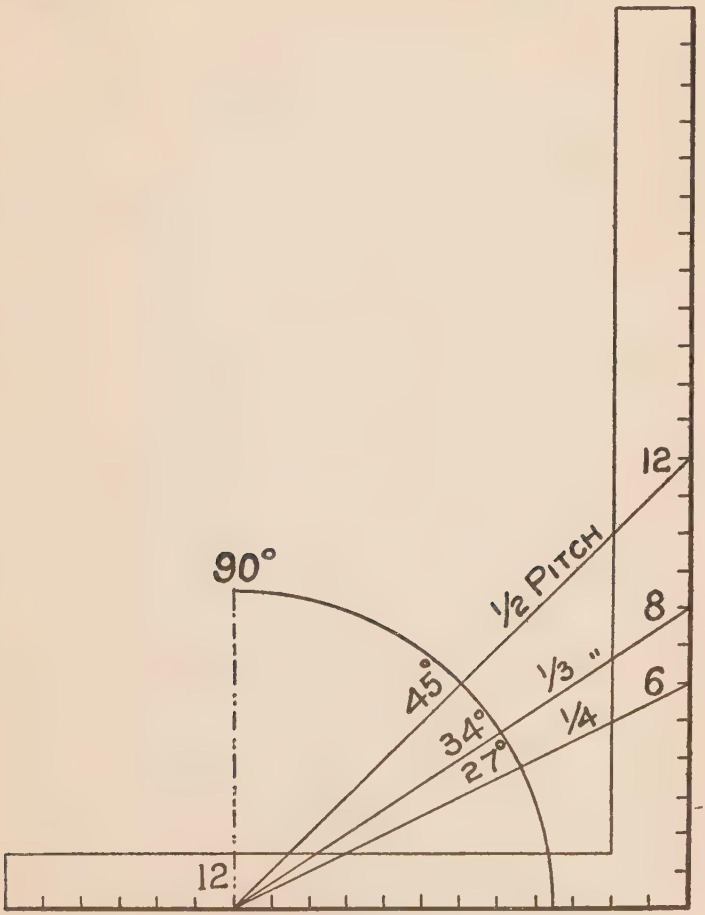


FIG. 195

A building 24 feet wide (as the rafters come to the center) has a 12-foot run and half-pitch, the

rise would also be 12 feet, and the length of the rafter would be 17 feet (the diagonal of 12). Length, cuts, etc., could all be figured from the one illustration.

Pitch Lines and Reversed Pitch.—In the illus-

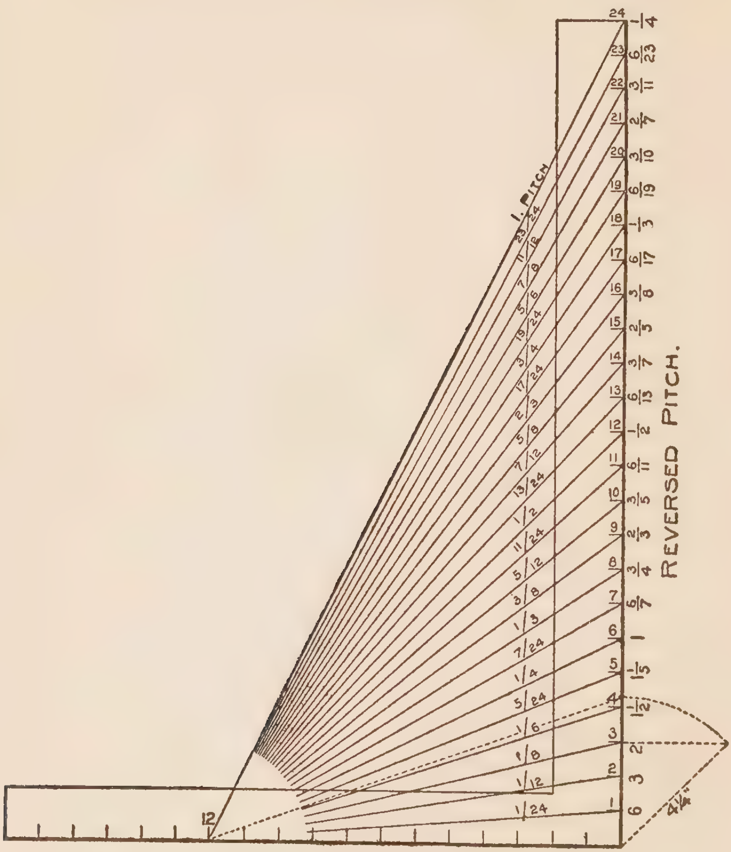


FIG. 196

tration at Fig. 196 we show the pitch lines up to the full pitch, also the reversed pitch. That is,

by letting the blade represent the run and the tongue the rise. The length of the pitch lines in that case becomes the length of the rafter for a one-foot rise to the inches in run taken on the blade. The reader will notice that several of the reversed pitches are to be found in the first column, though representing some other pitch, that is, the full pitch becomes the one-quarter pitch when reversed. The three-quarter, same as one-third, the two-thirds as three-eighths. The one-half being at the half-way point between horizontal and perpendicular, remains unchanged.

From this it will be seen that the low pitches become very steep when reversed. Thus, the one twenty-fourth pitch becomes 6 pitches or has a rise of 12 feet to a one-foot run. The one-twelfth pitch has a rise equal to 3 feet to a one-foot run, etc.

For the corresponding lengths of the hip or valley for these pitch lines, add five-twelfths to the run of the common rafter, which is the same as taking the diagonal of a square, whose sides equal the run as shown by the dotted lines for a 3-inch run, which in this case is equal to 4¼ inches, and measure diagonally across to 12 on the tongue will give the length per scale for the hip for each foot in rise of the common rafter. This, of course, reverses the seat and plumb cuts, on the square, and also causes a calculation that can be simplified by always reckoning the run on the tongue of the square regardless of the pitch given the common rafter.

Steep Pitches.—In Fig. 197 is shown how to apply the steel square for steep pitches. In this

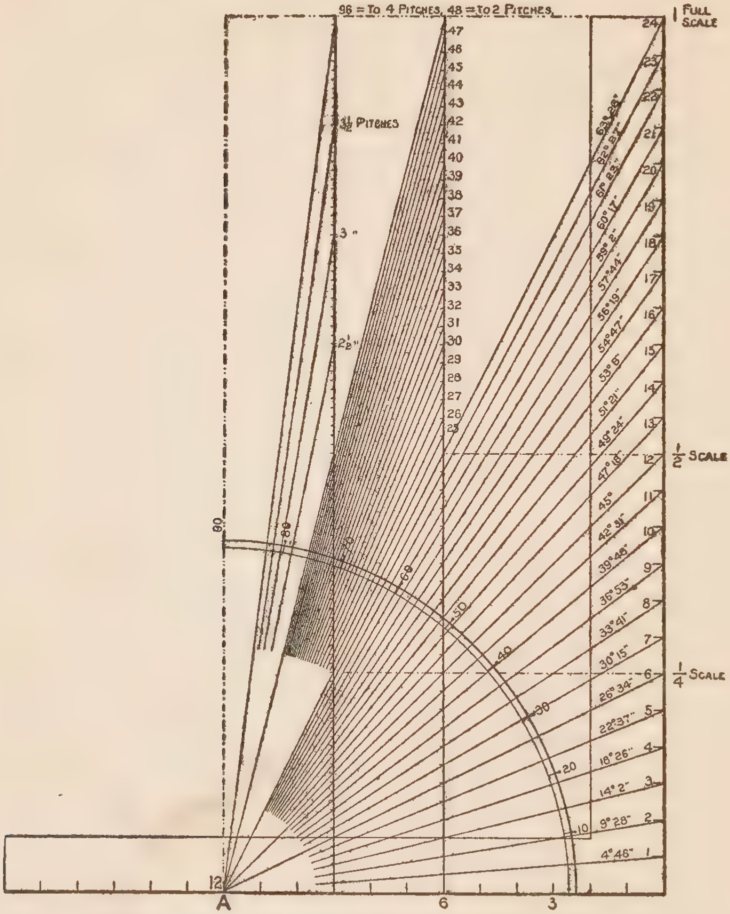


FIG. 197

illustration we show all of the pitch lines up to 96-inch rise to one foot in run, or four full pitches.

The pitch lines shown in connection with the steel square, represent the same up to the full pitch. Now leaving the pitch lines as they are and just imagine that we slide the square to the left until the 6-inch mark on the tongue rests at the starting point A, and it will be seen that the scale has been reduced one-half; in other words, the pitch lines would intersect the blade at the ½-inch marks, thereby permitting of a 48-inch rise to a one-foot run. The 48 being double 24 (the span) is therefore equal to two full pitches. If it is necessary for a still further reduction, just slide the square again to the left until the 3-inch mark on the tongue rests at the starting point. The pitch lines will then intersect the ¼-inch marks on the blade and permitting of 96 inches rise to one foot in run, or four full pitches. These, of course, are unusual, but the rule that applies to the common pitches, that is, those most generally used, necessarily applies to these.

For the corresponding hip or valley for the pitch lines above the full pitch, use 8½ on the tongue for the ½ scale and 4¼ for the ¼ scale. It will be seen that by the reduction in the scale, taken on the tongue of the square, permits of many pitch lines on the blade, thereby increasing the rise to any desired height.

In this illustration we give the degree and minutes of pitch for the common rafter up to the full pitch. To find the same for the reversed pitch lines, it is only necessary to subtract the degrees here given from 90 degrees. Thus—to

find the degrees for the full pitch when reversed, subtract 63° 26″ from 90°. To do this it must be remembered that it is necessary to borrow one degree from ninety and that one degree is equal to 60″ and should be expressed thus, 89° 60″—63° 26″=26° 34″, which will be seen is the same as that for a 6-inch rise or the one-quarter pitch. (Also see Fig. 196.) By referring to the degree scale in Fig. 197, the degree of the other pitch lines can be very nearly arrived at by scale as shown by the quadrant.

We trust we have made it clear that by using the tongue of the square to represent the run, instead of the blade as is the custom of most other writers, permits of the pitch lines up to the full pitch. Then again the blade being longer than the tongue gives a greater range of angles without reduction from the full scale to obtain the side cuts of the jacks and hips, which with this system are always on the blade, thereby helping to more readily fix on the mind the different cuts and where they belong on the steel square.

What Constitutes a Full Pitch.—We find builders differ as to what constitutes a full pitch, and this is not to be wondered at, because writers on the subject differ. There are a number of books on the market, one of which has reached considerable sale, a copy of which is now before us, illustrating the pitch lines on the square similar to that shown in Fig. 196, but designating each line as a whole, as 1, 2, 3, etc., pitch up to twenty-fourth pitch. Yet the universal theory of

12 and 12 taken on the square gives the seat and plumb cuts for the one-half pitch is the accepted practice and must prevail. What is true in this case must naturally follow when other figures are taken on the blade. Comparing it with the above method, twelve whole things would only be one-half of a thing. Six whole things are one-fourth of a thing, etc. In saying this we do not mean to be understood that we are trying to introduce some new fangled theory about pitches; far from it. We take it as is usual in the accepted practice and analyze it. In other words, if there is such a thing as one-quarter, one-third, one-half, three-quarter pitch, etc., then there must be a full pitch. This is arrived at by reckoning the rise given the common rafter in proportion to the span or width of the gable. It is therefore a full or a whole pitch when the rise equals the span. Taking it on the square;—the run being 12 inches, the span must necessarily be 24 inches and since the blade is 24 inches long, then the figures on that member are to the pitch as to its own (blade) length, and that is all there is to it. Then a line drawn from 12 on the tongue to each of the inch divisions on the blade will represent as many fractional pitches. These lines diverge from one another taken on the vertical line at the rate of one-twelfth of an inch to each inch in run. So at the twelfth-inch back from the starting point, the lines are 12-12 or one inch apart and intersects the blade at the inch divisions and represents the full scale for a one-foot run for all of the pitch

lines. Now let us look at the figures on the blade of the square, as shown in Fig. 198, and see what

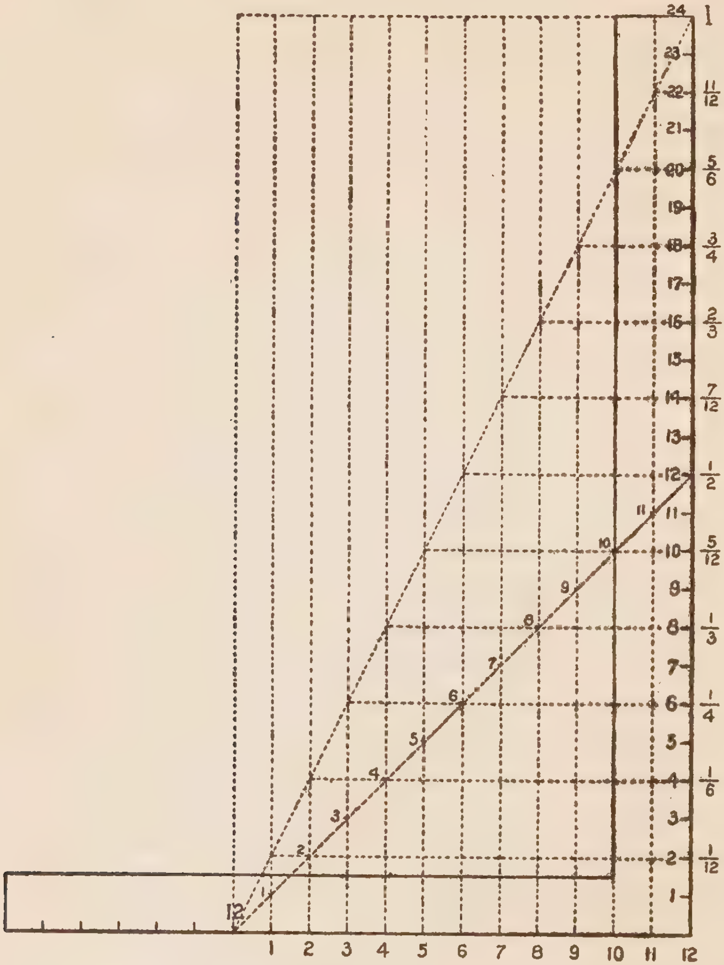


FIG. 198

relation they bear to those on the tongue. These figures as before explained represent the rise

given the common rafter to a one-foot run. The fractional numbers to the right of the blade

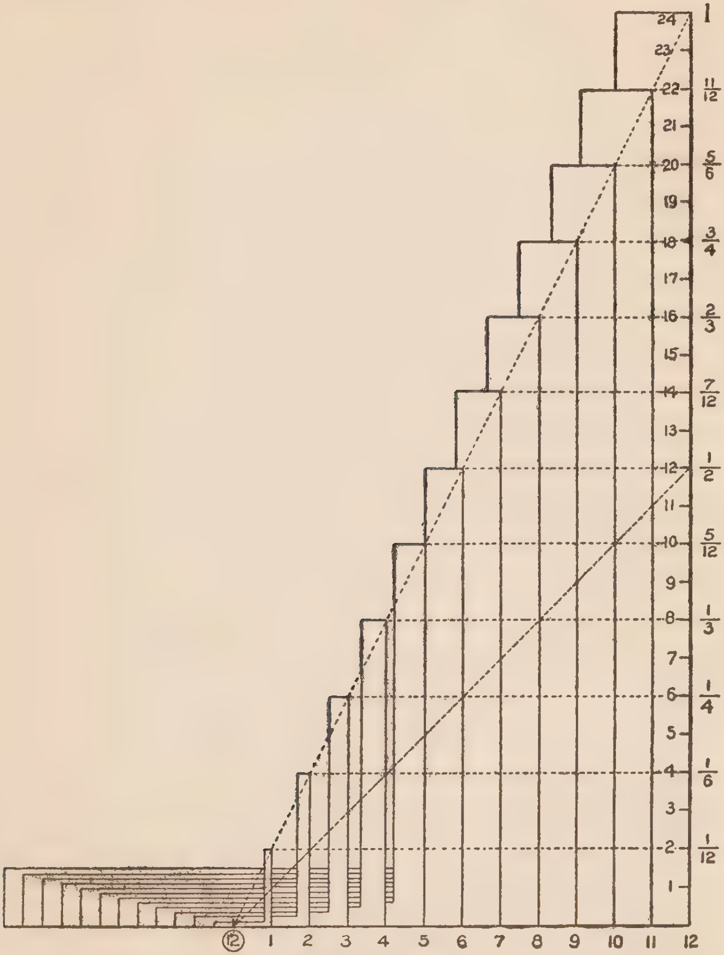


FIG. 199

represent the proportion of the pitch. Now follow the horizontal dotted lines from these figures

over to the full or one pitch, thence down to the desired pitch and the figures at this point and those in the run taken on the square will be to the same proportion as those for the full scale, but at different points on the square. For illustration see the one-half pitch.

In Fig. 199 is shown a similar drawing, but in this the squares are reduced in size ranging from one-twelfth up to the full size square. The fractional figures that denote the pitch, also denote the size of the squares in proportion to the full size square and these, if divided into as many parts as the full size square would give just the same results as far as the cuts and bevels are concerned, as will be seen by taking the one-half pitch, the line passes at the half-way point on the blade of all of the squares and consequently would give like results. However, squares are not made other than with the standard measurements. This illustration is given simply to illustrate proportional scales and that the size of the square would make no difference in the results so long as the divisions are to the ratio of the standard scale of measurements.

But we are not through talking about Fig. 198. In this illustration the vertical dotted lines from each inch in run represent the blade and the figures where the one-half pitch line crosses these lines and that denoting the run will give the seat and plumb cuts for the common rafter, as 1 and 1, 2 and 2, 3 and 3, etc. Now let us apply this to some other pitch. For an example we will

take three-eighths pitch, as shown in Fig. 200. Remember the full pitch regulates the scale in proportion to the full scale for any rise under 24 inches. The full scale for the $\frac{3}{8}$ pitch is 12 and 9. Why? Because 9 is $\frac{3}{8}$ of 24.

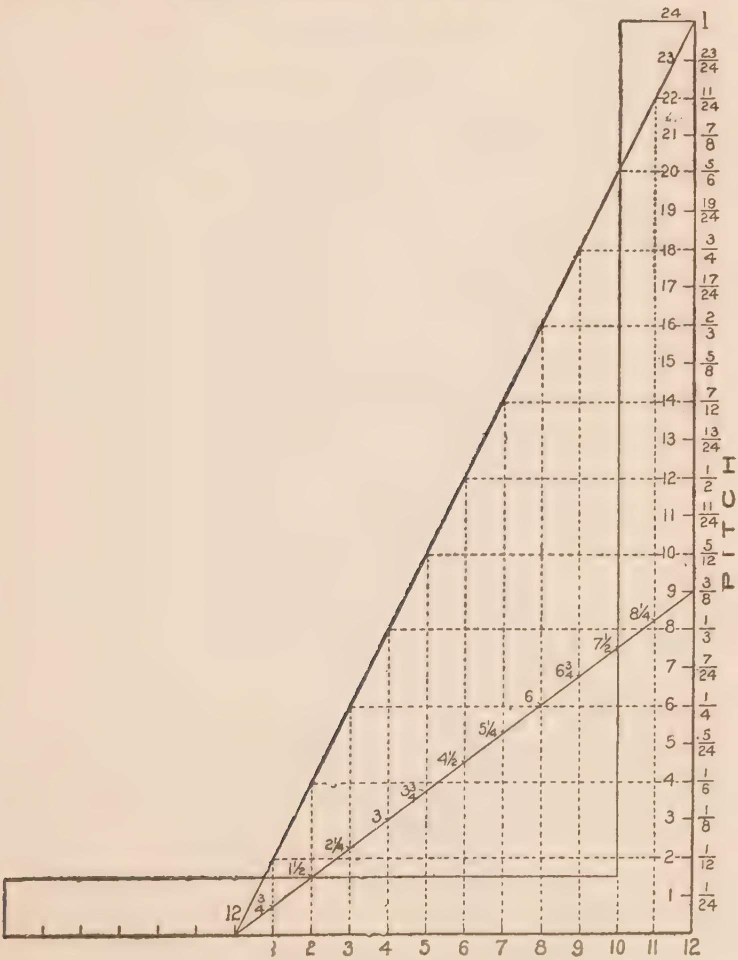


FIG. 200

To find the $\frac{1}{4}$ scale for the above pitch, take 6 on the blade and follow the horizontal line to the left till it intersects the one pitch, thence vertically down to the $\frac{3}{8}$ pitch, and it will be found that this intersection is at $2\frac{1}{4}$ inches above 3 on the run, and it will be seen that these figures are $\frac{1}{4}$ that of 9 and 12.

For the 5-12 scale, proceed in like manner, starting from 10 on the blade. The intersection on the pitch line will be $3\frac{3}{4}$ inches above 5 on the run. Thus every inch of the blade's length represents a distinct scale, and these are subject to many more scales. If the blade of the square be divided in twelfth inches, each division will represent a scale, making in all 12 multiplied by 24, equals 288 different scales; but these divisions run into intricate fractions for the rise, and only one-half of the runs will end in twelfths of an inch. The other half will end in twenty-fourths, but all of these scales will be in the same ratio as that given for the full scale, and consequently give the same result as far as the angles are concerned. However, it is better to use the full scale when

FIG. 201

same can be done, as it is handier and insures more accuracy in the work.

To Cut Rafters with The Square.—Fig. 201 il-

lustrates a way to cut rafters with a square. A roof 14 feet wide would have a run of 7 feet, third-pitch would rise 8 inches to every foot run. Therefore, place the square on 8 and 12 seven times, and you have the length and cuts.

Fig. 202. For the octagon rafter, proceed

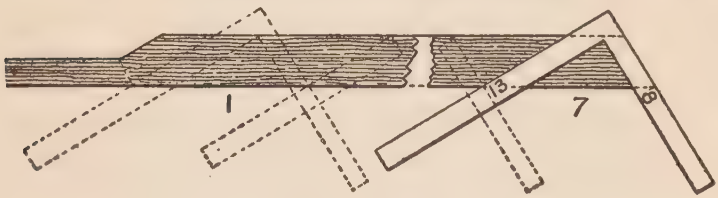


FIG. 202

same as for common rafter, only use 13 for run (in place of 12 for common rafter).

Fig. 203, hip or valley rafter. As these rafters run diagonal with the common rafter and as the

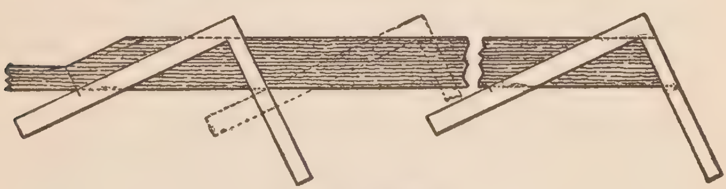


FIG. 203

diagonal of one foot is practically 17 inches, use 17 for run, and proceed the same as for common rafter.

Length of Jacks.—If there are to be five, divide the common rafter into six equal parts, use that for a pattern, and it gives the length very nicely. But that will not always work. To get all the dif-

ferent lengths might at first, look difficult even to many good mechanics, but it is very simple as

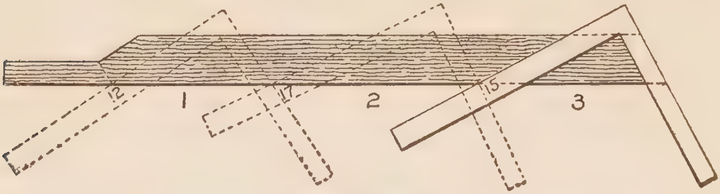


FIG. 204

illustrated in Fig. 204. If the first jack was one foot from corner, apply the square the same as for common rafter, and it gives length and cut (mark the length for starting point on next), and if it is 17 inches from the other, move the square up to 17, if the next is 15 move up to 15 and so on.

Fig. 205. The side cut of jack to fit hip, if laid down level would, of course, be square miter,

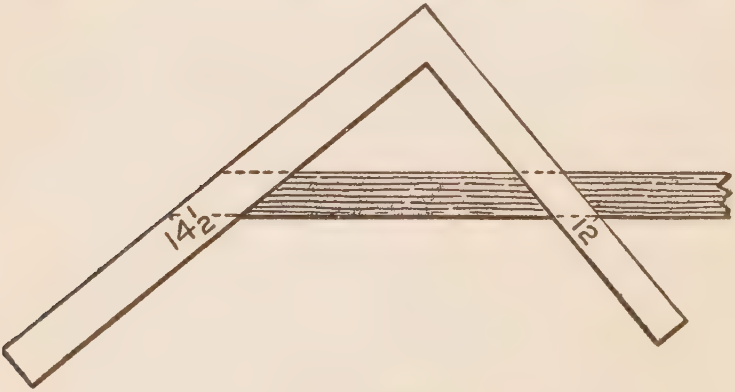


FIG. 205

but the more the hip rises the sharper the angle. Measure across the square from 8 to 12, and it is

nearly 14½, which is the length of rafter to one foot of run. Length and run, cut on length, gives the cut.

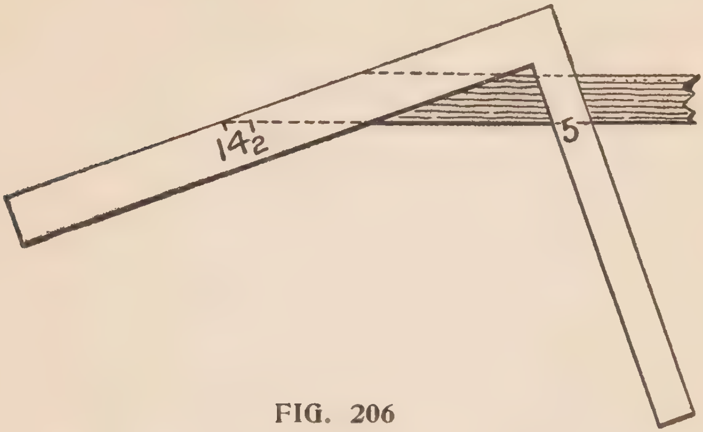


FIG. 206

Fig. 206, octagon jack. As the octagon timer on level surface is 5 and 12, it must raise

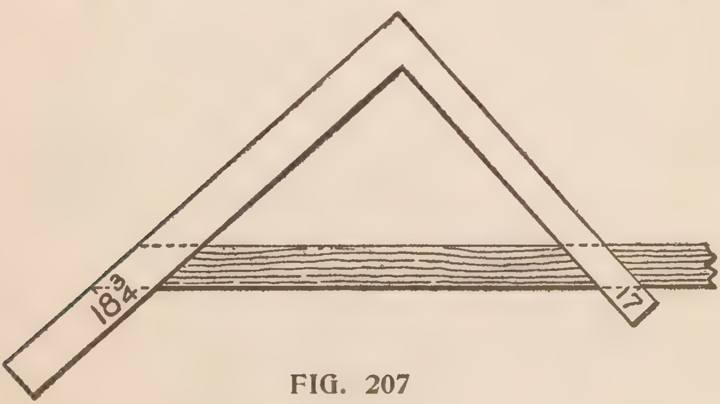


FIG. 207

same as common jack, and is, therefore, raised to length, or 14½, and 5 cut on length.

Fig. 207, hip rafter, is also length and run, cut on length.

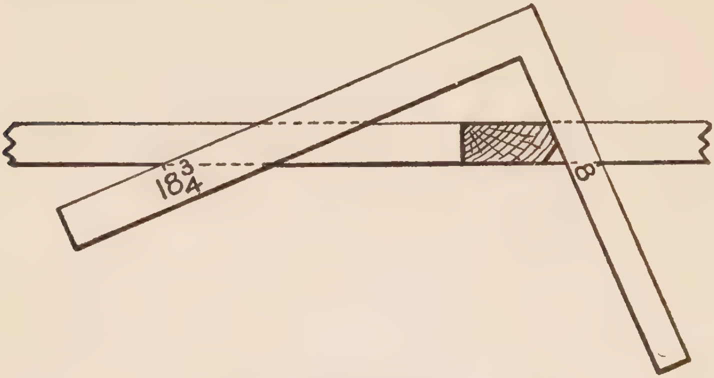


FIG. 208

Fig. 208. To bevel top of hip take length and rise and mark on rise.

Fig. 209 is another practical way, which is

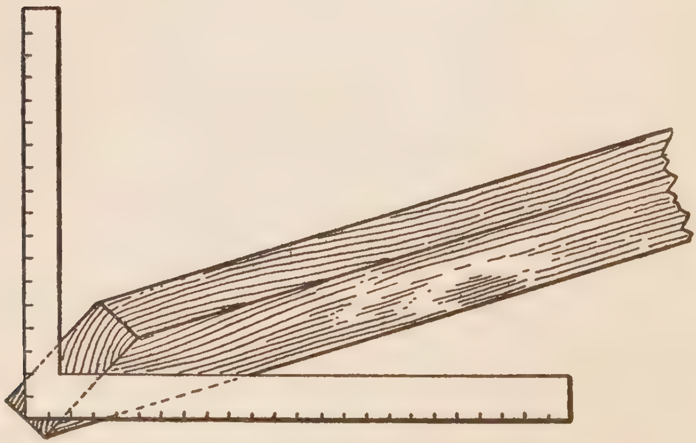


FIG. 209

simply to lay the square on heel of hip. The illustration explains itself.

Simplest Way to Frame a Roof.—Perhaps the most practical way of all to frame a roof, the simplest to understand, easiest to remember, and most rapid to apply, is simply to always take the rise and run, measure across the square which gives the length. Rise and run gives cuts, so you have it all.

Fig. 210 illustrates a roof 25 feet wide and a

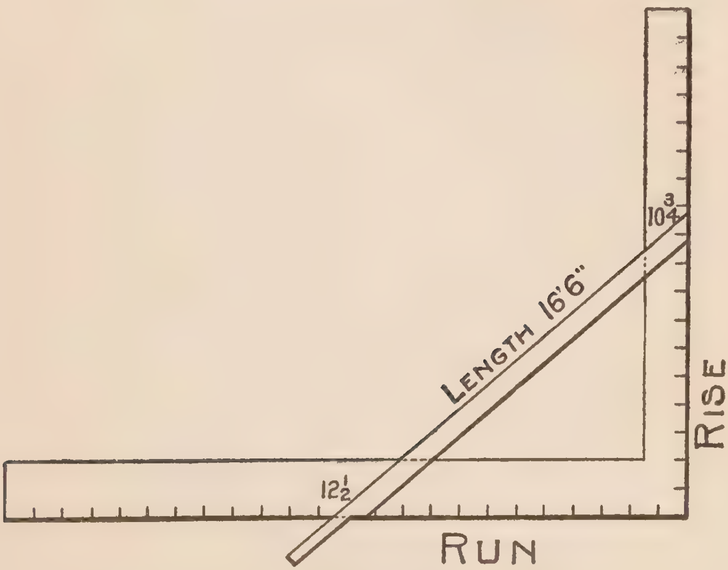


FIG. 210

rise 10 feet 9 inches, run 12 feet 6 inches. Measuring across the square from $10\frac{3}{4}$ to $12\frac{1}{2}$ gives $16\frac{1}{2}$, or 16 feet 6 inches is the length of rafter.

Fig. 211. If the run of common rafter is $12\frac{1}{2}$, the run of the hip will be diagonal of $12\frac{1}{2}$, which is 17 and 8-12, as is plainly illustrated.

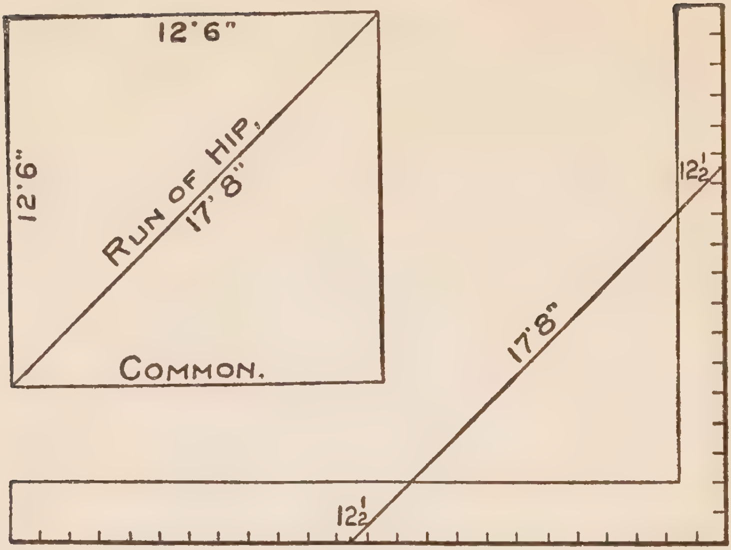


FIG. 211

Fig. 212. As the rise is $10\frac{3}{4}$ and run 17 and 8-12, the length will be 20 feet and 2 inches.

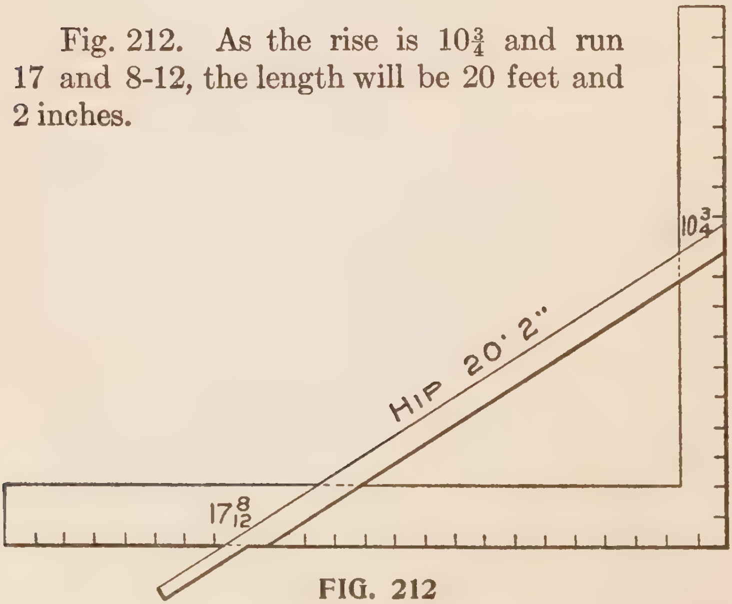


FIG. 212

Additions, Porches, etc.—Fig. 213. When a roof must go to a certain height to strike another building at a given point, as in additions, porches, etc , don't forget in getting the rise from plate to

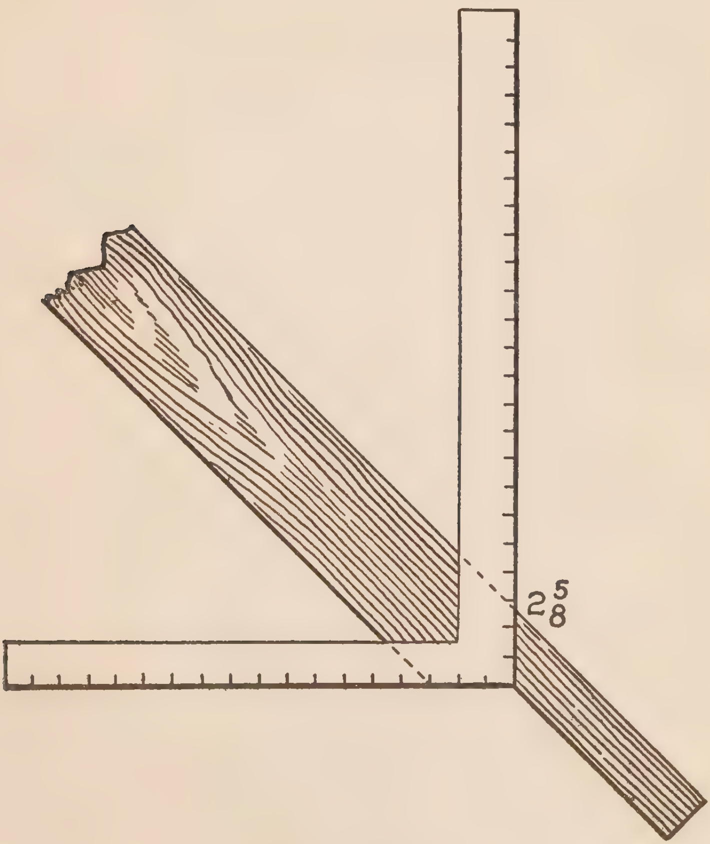


FIG. 213

given point to allow the squaring up of heel as illustrated; and also remember to allow for ridge whenever one is used.

Fig. 214 illustrates the cut of top of quarter-pitch rafter to lay on top of roof just mentioned. To apply square, first lay it on 12 and 6, which is quarter-pitch, and gives plumb-cut. From plumb-cut lay off pitch of main roof $10\frac{3}{4}$ and $12\frac{1}{2}$, which gives cut.

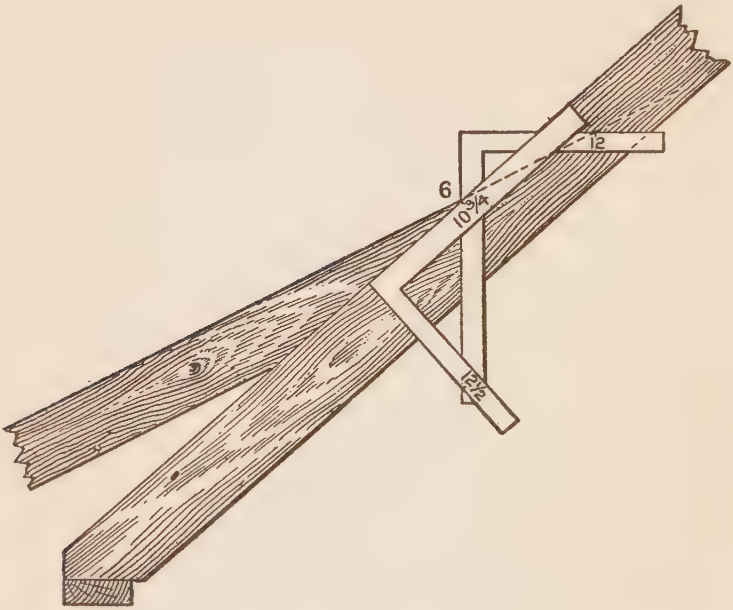


FIG. 214

It is quite clear that a common rafter becomes a hip for a building of less span, as will be seen by referring to Fig. 215. Here the common rafter for a 12-inch run becomes a hip for an $8\frac{1}{2}$ inch run. A hip for a 12-inch run becomes a common rafter for a 17-inch run. Therefore, the same rule must apply to both, that is, the tangent (commonly called

run) and rise, taken to scale on the square will give the seat and plumb cuts. The tangent and the length of the rafter taken to scale on the steel square will give the side cut for the hip to rest

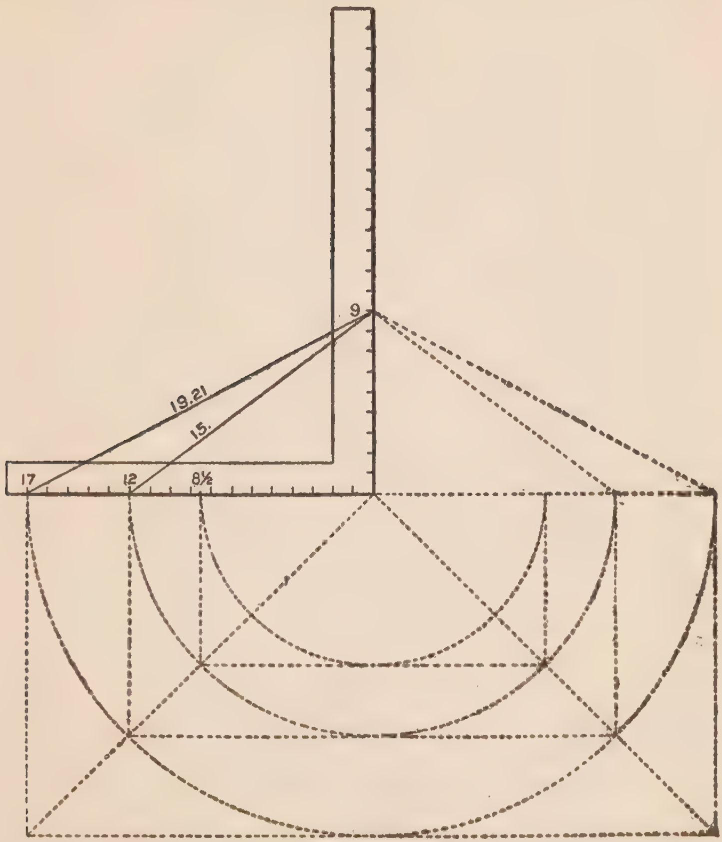


FIG. 215

against the ridge tree. Cut on length. The same applies for the common rafter, which gives the side cut of the jack to rest against the hip or valley.

Taking the full scale for the hip as compared with the common rafter, it is practically 17 on the tongue and the length of the hip for a one-foot run of the gable taken on the blade, and the latter will give the cut. If 12 is used on the tongue for

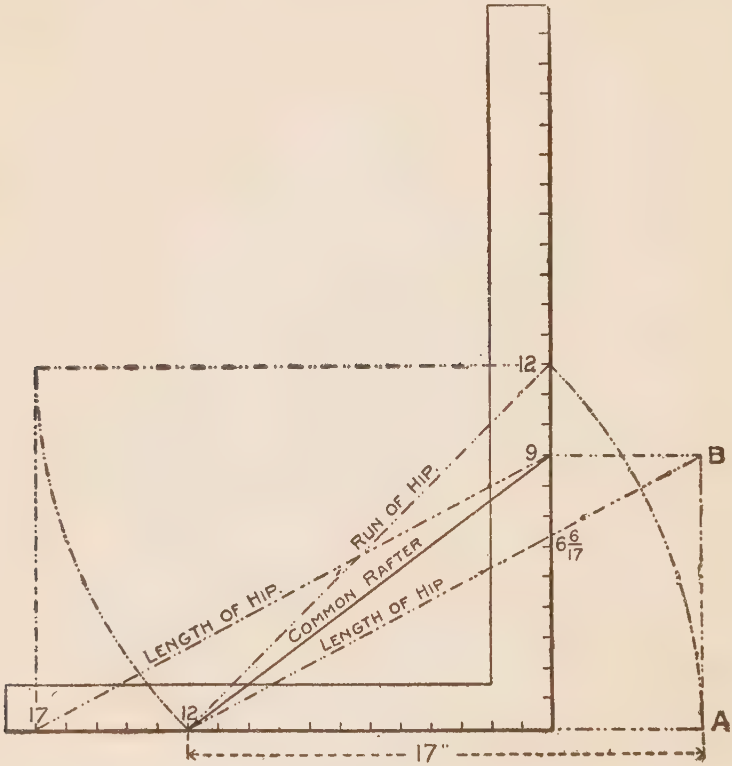


FIG. 216

a foot run of the hip, its rise would necessarily be less than for the same run of the common rafter, as will be seen on Fig. 216. In this is shown the corresponding difference for the $\frac{3}{8}$ pitch. The

diagonal line from 12 to 12 represents the length of the run of the hip, and this taken on a continued line of the run of the common rafter, as at "A," and erect the rise equal to that of the common rafter as at "B," and it will be seen a line from this to 12 on the tongue passes at 6 6-17 inches on the blade; because the common rafter having a rise of 9 inches to one foot, for one inch, it would only have 9-12 of an inch, while the hip would only have 9-17 of an inch to one inch. Then for 12 inches it would be 12 times 9-17, equals 108-17, or 6 6-17 inches. Therefore, 12 on the tongue and 6 6-17 on the blade will give the same result as 17 on the tongue and 9 on the blade, but as the former method necessitates a calculation that ends in fractions —fractions not given on the square—it is better to use the latter method because it obviates the fractions. In this illustration is also shown why 17 is used on the tongue, which is simply taking the length of the run of the hip on that member, as shown by the course of the dotted lines. A line from this point (17) to the rise of the common rafter, represents the length of the hip or valley for a one-foot run to correspond with that for the common rafter and is parallel with the line from 12 to "B," as in the former method. Thus 17 is a standard number on the tongue for the hip or valley, just the same as 12 is used for the common rafter, the rise remaining the same avoids computations and greatly simplifies the work. While 17 is used on the tongue to obtain the cuts, the actual measurement is a little less than 1-32 of an

inch of being 17 inches. This, however, is too small to consider, but the lengths of the rafters for accuracy should be reckoned from 16.97 inches.

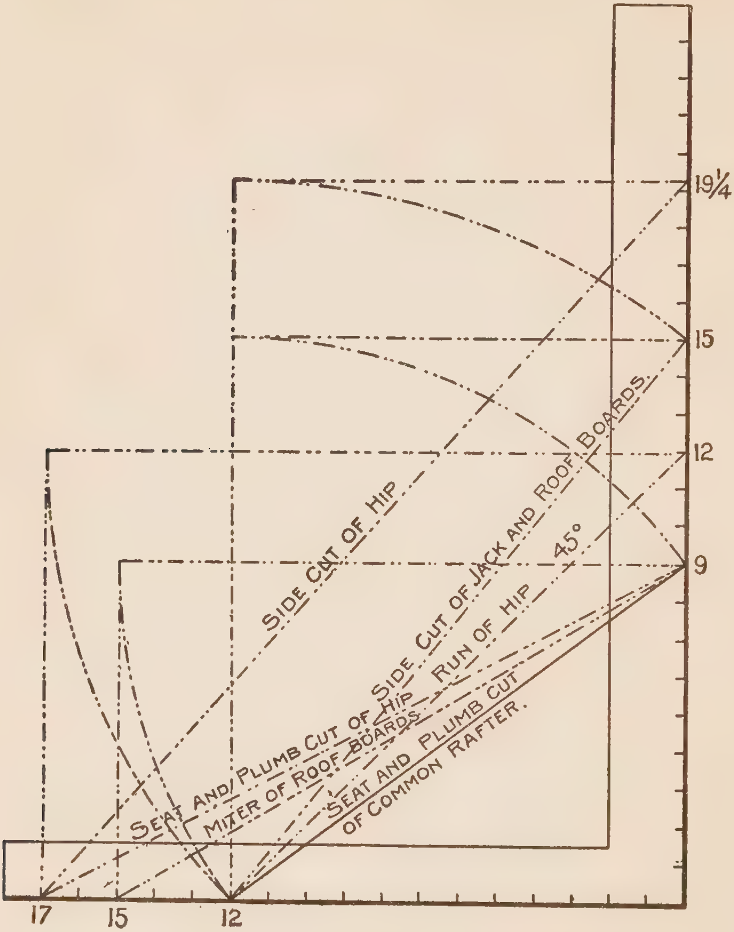


FIG. 217

In the foregoing, we have tried to lead up more to the cause and effect and have in a general way

touched on the different cuts about the roof, showing at the same time why they give correct results.

We will now take up the subject showing the various cuts in one diagram as shown in Fig. 217. Here are shown the measurements on the steel square.

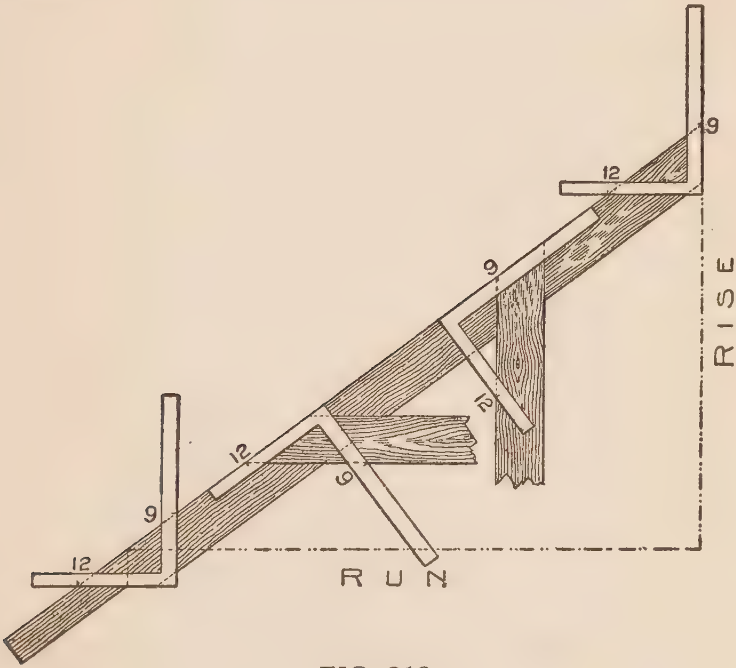


FIG. 218

For example we will take the $\frac{3}{8}$ pitch. Take 9 on the blade. Why? Because, the run being 12 inches, the span must be two times 12, which equals 24, and since the pitch is reckoned by the span, we find that $\frac{3}{8}$ of 24 is 9, and therefore rep-

resents the rise to the foot run. Then 12 and 9 gives the seat and plumb cut of the common rafter. They also give the cuts for the gable boards resting either horizontally or perpendicularly as shown in Fig. 218.

The Cuts, Lengths and Bevels of Rafters are all contained in the cube as shown in Fig. 219. The base of the cube being twelve inches square, while

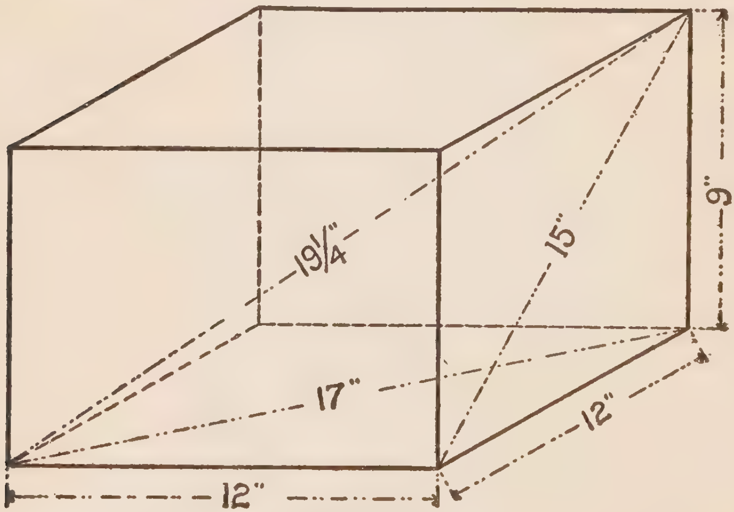


FIG. 219

the altitude is regulated by the rise given the common rafter to a one-foot run, which in this case is 9 inches or $\frac{3}{8}$ pitch. This is one of the best methods of fixing on the mind the true position of the different rafters and why certain figures are used on the square to obtain the cuts. We will carry this thought a little further and show the corner of a hip roof in an imaginary cube with dimensions

equal the run and rise given the common rafter, as shown in Fig. 220. Here the common rafter, the jacks and the hip are shown in position with their relative runs, rises, lengths, cuts and bevels all shown in this illustration. If the corners of the building are other than at right angles, then

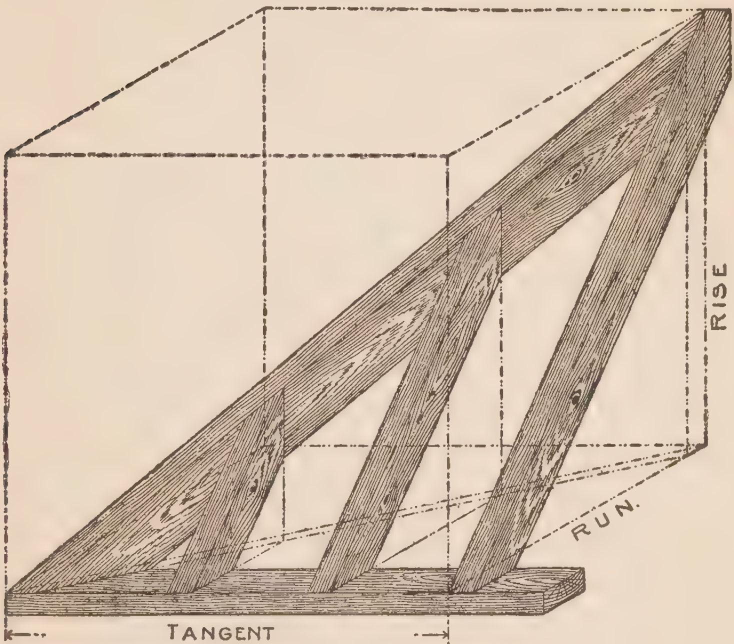


FIG. 220

the base of the cube would be to the same shape as that of the corner of the building.

Plan of Roof.—In Fig. 221 is shown a roof plan with right-angled corners and containing an octagon bay. This answers for any pitch given the roof, as there is nothing in it to distinguish the pitch.

In fact it would show just the same if there was no pitch given at all, consequently all of the angles for the side cuts are at an angle of 45 degrees. If there was no pitch, it would simply be the common miter of 12 and 12 on the steel square, 12 being used

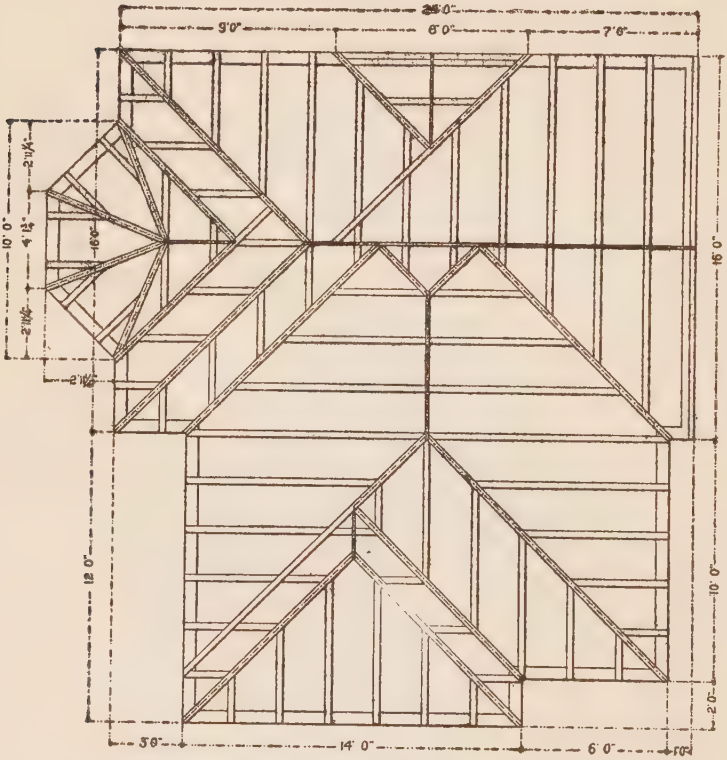


FIG. 221

on one arm of the square because it represents the length of the tangent when the run is one foot and remains so regardless of the pitch given the roof. 12 is used on the other arm of the square because

it represents the length of the rafter for one-foot run when there is no pitch given. Therefore, we let 12 on the tongue represent the tangent because it is a fixed number and answers for any pitch. When there is a pitch given the rafter, its length is increased. Thus, in the $\frac{3}{8}$ pitch, the length is 15 inches. Therefore, 12 on the tongue and 15 on the blade gives the side cut of the jack as before illustrated. If we were to cut off the peak end of the jack rafter on a parallel line with the seat cut after the side cut has been made, the angle would show just what we started from—the 45-degree angle. For the side cut of the hip, it would be 12 and 6 6-17, but in order to avoid the fractions it is better to use 17 on the tongue, as described in connection with the above figure.

The run and tangent in the case of the square cornered building being equal is very misleading. 12 taken on one arm of the square is generally ascribed to the run, when, as a matter of fact, it has nothing to do with it. The run of the rafter and its length (which gives the same result as 12 on the tongue and the length of the rafter for a one-foot run taken on the blade) gives the side cut of the jack rafter for the square-cornered building and no other. Not because 12 stands for one-foot run of the common rafter, as is generally supposed, but because the tangent equals the run, and is therefore not a general rule, but one of the things that centralizes at 45 degrees.

Now let us apply our unity rule, which, as will be seen, applies to any kind of a corner, whether

square or any other shape. The rule applies to all alike. It is the tangent or the figures on the blade that give the miter when 12 is used on the tongue. These figures transferred to the tongue, and the length of the common rafter for a one-foot run of the given pitch taken on the blade will give the cut. The blade giving the cut. Now, for an octagon roof. The tangent for the octagon is 4 23-24 or practically 5 inches. This taken on the

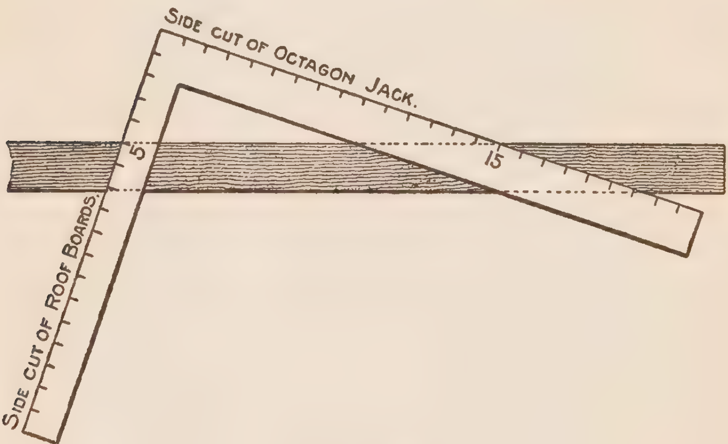


FIG. 222

tongue and 15 (the length of the rafter for the $\frac{3}{8}$ pitch) on the blade gives the side cut of the jack, and the corresponding cut across the face of the roof board to fit over the hip. The blade giving the cut in the former and the tongue in the latter, as shown in Fig. 222.

What is true of this, is true of any other polygonal roof. In Fig. 223 we show the tangents on the blade for the polygons from 4 to 10 and rep-

resent the figures to use on the tongue of the steel square instead of 12, as in the square-cornered building. In connection with this illustration are

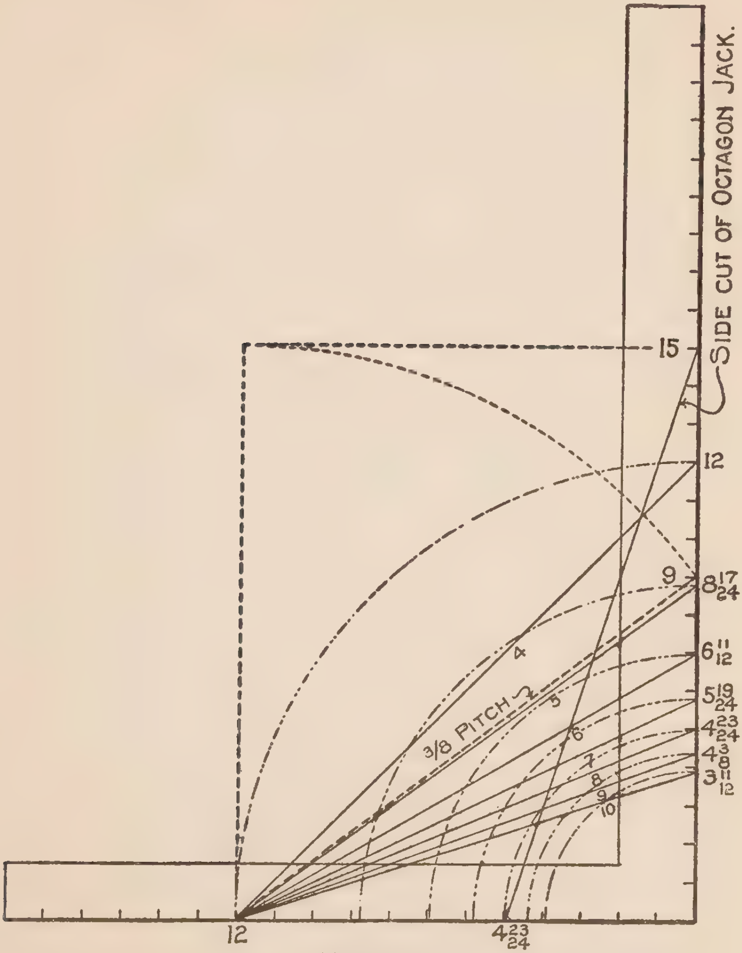


FIG. 223

shown the figures to use for the octagon as applied in Fig. 222.

Measurement Line of All Jacks, Hips and Valleys.—The true measurement line of all jacks, hips and valleys is at a line along the center of the back, and just where to place the square on the side of the rafter so as to make the cuts and length come right at that point is a question that taxes the skill of most carpenters, especially so in the

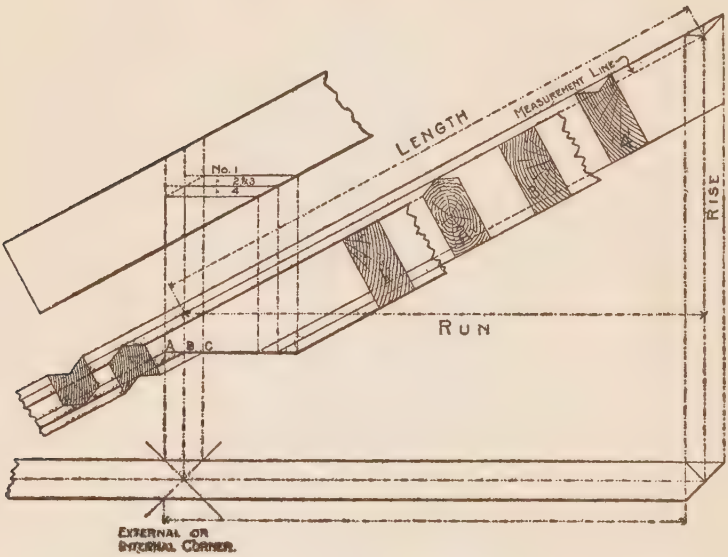


FIG. 224

case of the latter, where the same are to be backed.

In Fig. 224 we show the hip and valley under different conditions for a square-cornered building. Beginning at the bottom is shown the plan of the rafter. The cross lines on same represent the angle of the plates for either hip or valley. Above the plan is shown the elevation. The sections 1-2-3-4

represent the position of the rafters under the following conditions:

No. 1, hip when not backed; No. 2, hip when backed; No. 3, valley when not backed; No. 4, valley when backed. No. 1 is outlined by heavy lines and apparently sets lower than the others. By tracing the bottom line of the sections down to the seat of No. 1, thence up to the second elevation, will show just how far in the seat cut should be for each rafter. No. 1 cuts into the right-hand vertical line above the plan, as at C, which would make it stand at the right height above the plate, at the outer edge of the rafter, but in order to make the seat cut clear the corner of plate, it is necessary to cut into the center line B. No. 2 cuts into the same point as No. 1 ,but owing to its being backed, the seat cut drops accordingly. No. 3, which is for the unbacked valley, also cuts into the center vertical line, and in order to clear the edges of the plate, must cut out at the sides to the left vertical line. No. 4 cuts in the same depth as the latter, but as much lower than Nos. 2 and 3 as they are below No. 1. The vertical lines "A" and "C" from the plan represent the width of the rafter. Therefore, if the rafter be two inches thick, the lines A-B-C would be one inch apart, and this amount set off along the seat cut, or a line parallel with it, will give the gauge point on the side of the rafter. To make this clearer, we refer to Fig.225. 17 and 9 give the seat cut. Now leaving the square rest as it is, measure back from 17 one-half the thickness of the rafter, which would locate the

gauge point at 16, and this will be the point for the line from which to remove the wood back to the center line of the hip. The measurement from the

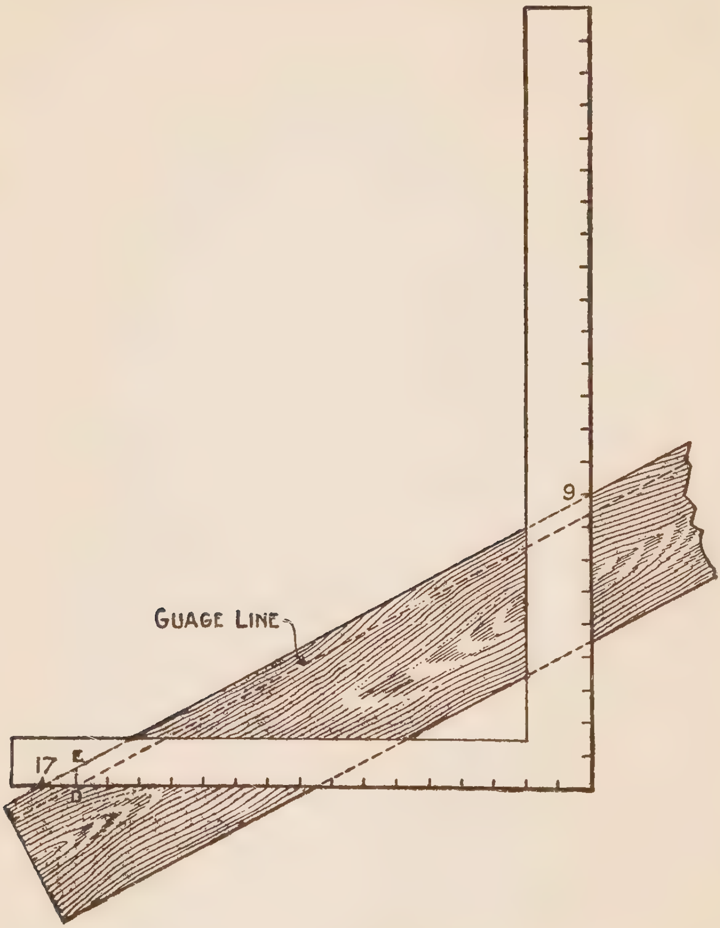


FIG. 225

gauge point taken square out from the seat cut to the edge of the rafter as shown at D-E, shows how

far apart the parallel lines of the seat cut will be under the above conditions. This rule applies to any pitch given the roof so long as the pitches are regular.

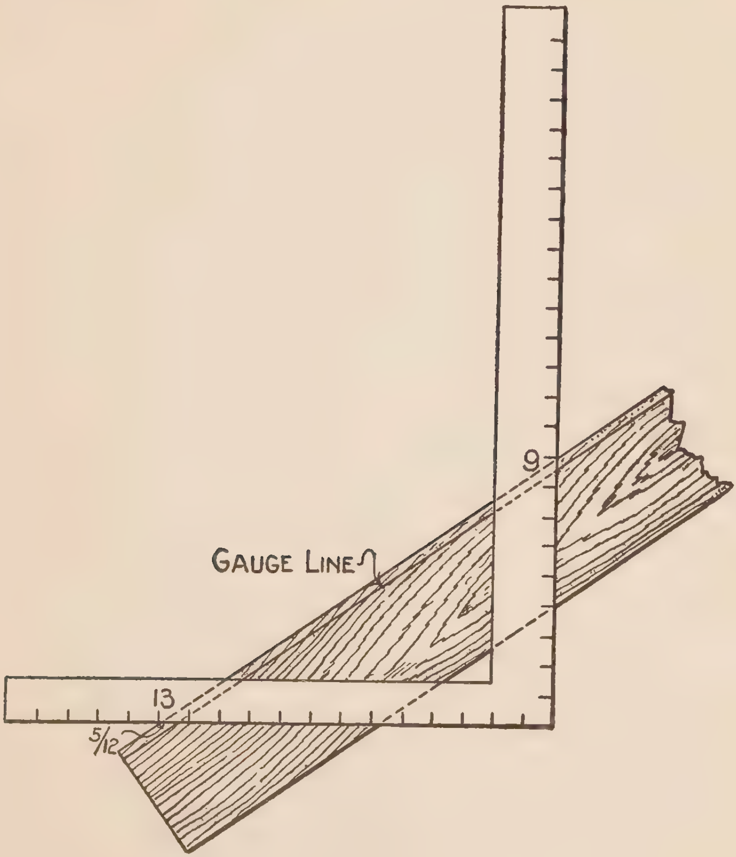


FIG. 226

Backing Line for Octagon Hip.—We show in Fig. 226 the backing line for the octagon hip. From this, it will be seen, that the method is the

same as that for the hip resting on a square corner, which is shown in Fig. 225. In this 17 and 9 give the seat and plumb cuts for the $\frac{3}{8}$ pitch while 13 and 9 give the corresponding cuts for the octagon hip. In the former a point 12 twelfths or one inch, is taken back from the edge of the rafter along the seat cut for the gauge line, while in the latter, the point is taken 5 twelfths back. The backing for any other polygonal hip may be readily found in the same way by setting off the tangent for one-half the thickness of the hip. Thus for the hip resting on a square corner, the tangent is equal to one-half of the thickness. In other words, the amounts to set off are the same figures as those used to obtain the side cut for the corresponding jack (see the figures opposite the blade in Fig. 223), but consider them as so many twelfths of an inch. Thus it is 12 twelfths, or one inch, for the square-cornered building, $8\frac{3}{4}$ twelfths for the pentagon, 7 twelfths for the hexagon, 5 twelfths for the octagon. The figures to use for other polygonal roofs are shown in Fig. 223, but the reader must bear in mind that the fractional part of the number becomes only that part of a twelfth on an inch. Thus, for the octagon the number is 4 23-24, which is lacking only 1-24 of a twelfth of an inch of being 5 inches. This is so near being 5 that we call it 5 twelfths of an inch for the amount to set off on the seat cut line as before described and shown in Fig. 226.

For a Triangular Building.—The backing line for a hip for a triangular building would be 21

twelfths or $1\frac{3}{4}$ inches to set off on the seat cut line, the latter being obtained by using 21 and 9 as compared with Figs. 225 and 226.

The backing of the hip is too often neglected. In fact, in most cases is not done at all, or if it is done, it is in a haphazard sort of a way. We have seen laborers (we will not say carpenters) take a hand-ax and hew off the corners of the hip, after it was set in place, at the time of putting on the sheathing boards. The valleys too should be backed and in most cases should be doubled on account of the downward thrust of the roof causing etxra weight on the valleys. However, it is not our intention to discuss construction in this work, but where the valleys are so doubled they should be backed one way only and that before spiking together. This makes a substantial valley and solid bearing for roof boards.

Tail End Cut of Hip or Valley.—This, too, is one of the neglected cuts, and carpenters generally pay no attention to it further than to leave the tail end long enough to catch the facia and then scribe the end cut to correspond with that of the common rafter.

In Fig. 227 we show this cut as at "A" and how it may be obtained with the steel square. From this, it will be seen that it is rather a difficult thing to get at, since the measurements are, so to speak, in another latitude. In all roofs there is an unseen, or co-pitch, and the end cut of the common rafter represents that pitch, and which, if cut square, will rest at 90 degrees from

the given pitch of the common rafter, and the cut in question must necessarily coincide with the unseen or co-pitch.

In Fig. 228 is shown the application of the

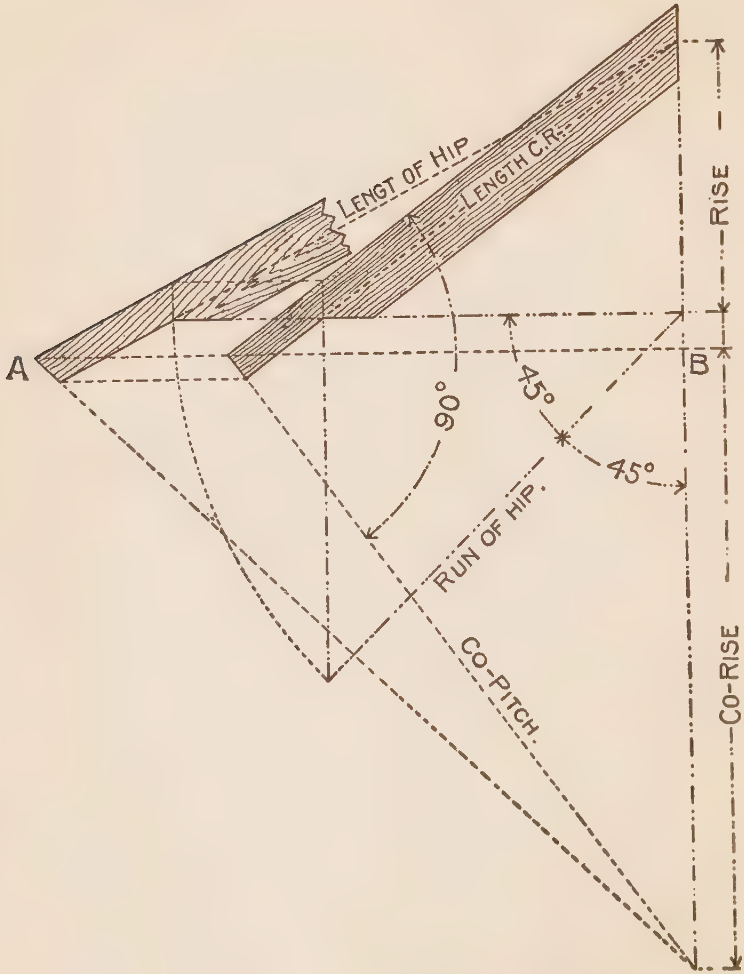


FIG. 227

steel square for the seat and plumb cuts for the $\frac{3}{8}$ pitch for the common rafter and the corresponding hip for the octagon and square cornered

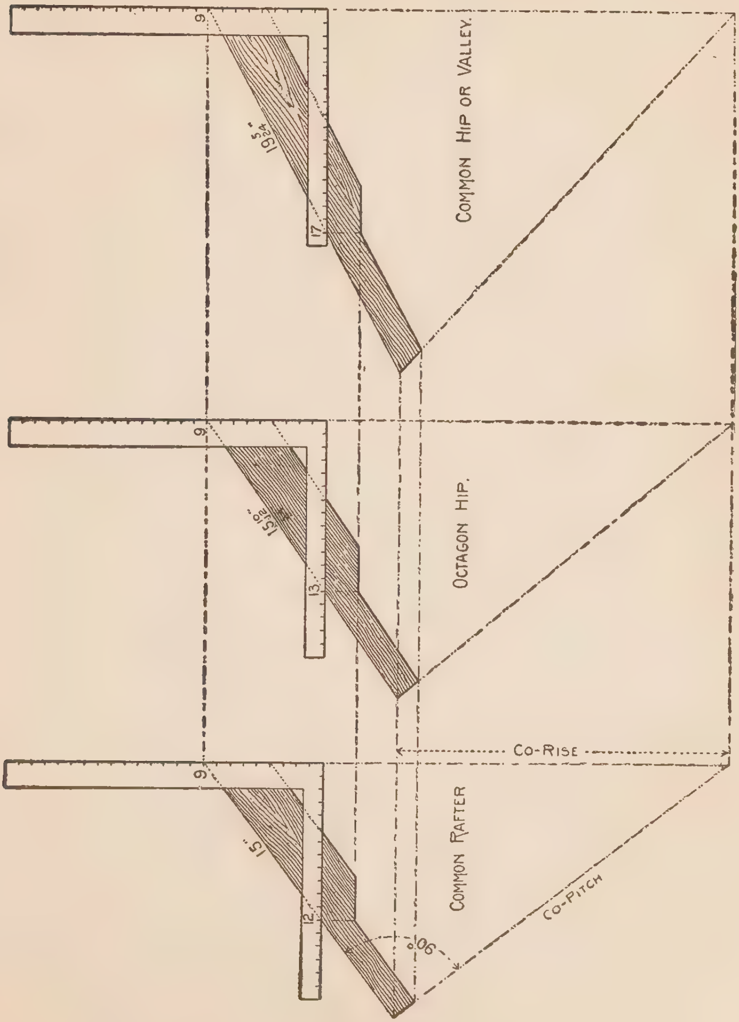


FIG. 228

building. The dotted lines clearly show the angle that the tail end cut must bear to that of the common rafter.

There is no general rule, so far as we have been able to find, whereby this cut can be had

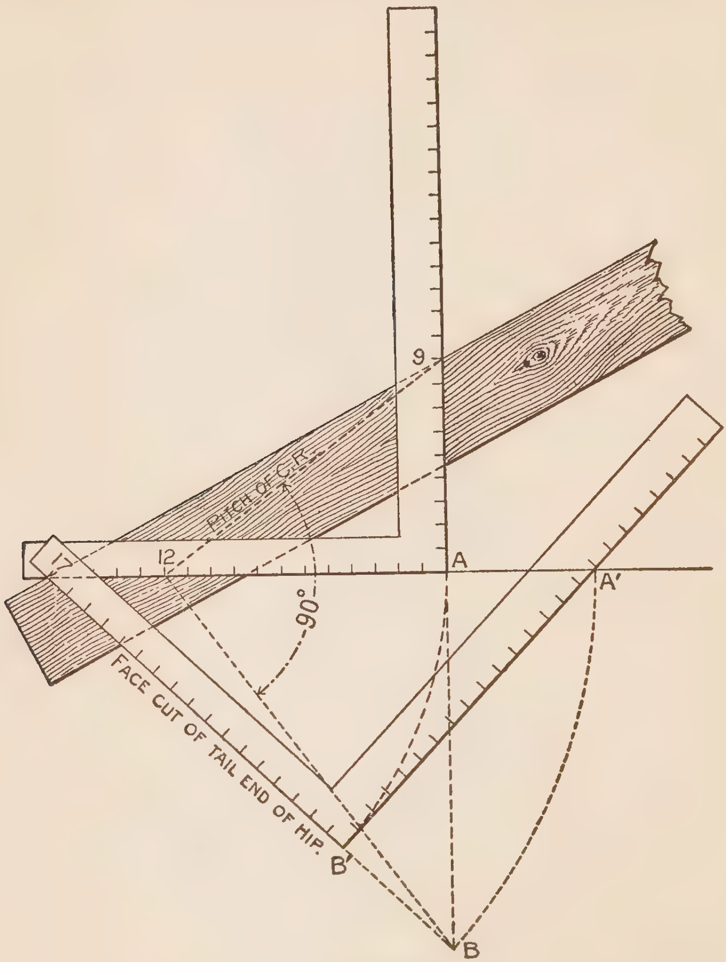


FIG. 229

direct from the edge of the rafter, as in other cuts, but it may be had by taking the run (17) on the tongue and the co-rise on the blade and applying this to a line parallel with the seat cut and the tongue will give the desired cut as shown in Fig. 229.

However, this is only the angle or where the cut would be at the center of rafter. To get the proper angle on the side of the rafter, the cut would pass through the point on the seat cut as before described for the backing lines.

The foregoing practically covers all of the cuts and bevels about the even pitch roof that may be readily obtained with the aid of the steel square. There are, of course, other ways of arriving at the same result by geometrical diagrams, etc., but there can be nothing better than a thorough knowledge of the tangents of the steel square and the relation that they bear to one another.

Side Cut of Jacks.—In Fig. 230 we show the side cut of the jacks from a 4 to 24-inch rise to the foot run and for polygonal corners from 4 to 12. In this illustration we show the figures to use on the steel square for twenty of the pitch lines and for the square corner and eight of the polygonal jacks, also for the level miter making in all 220 side cuts, or miters, that can be had from this illustration alone. Since the tangents of the polygons govern the figures to use on the tongue, they are as shown in connection with this illustration. Thus, to obtain the side cut of

the pentagon jack for the $\frac{3}{8}$-inch pitch, we use $8\frac{3}{4}$ on the tongue and 15 on the blade. The blade giving the cut.

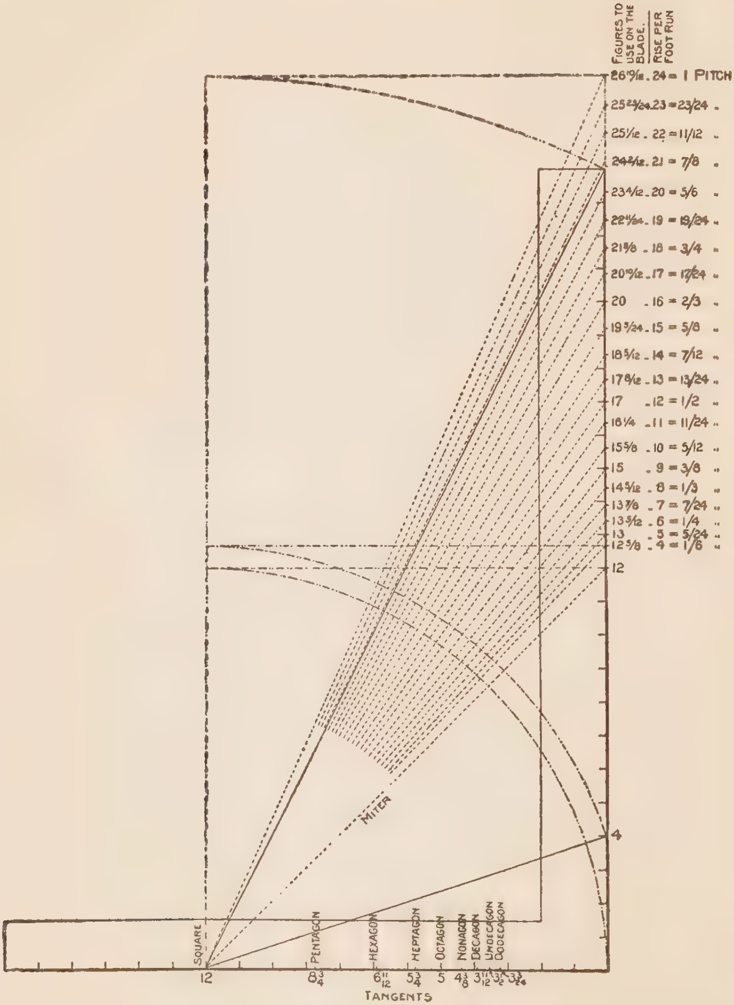


FIG. 230

Hexagon Jack.—Proceed in like manner for the hexagon jack, using 6 11-12 on the tongue, and so on to the end. The reader will notice that several of the pitch lines are beyond the length of the blade and in that case it is necessary to reduce the scale, which may be done by taking one-half of the lengths here given on the blade and tongue. The tangent for the triangle is practically $20\frac{3}{4}$ inches, which is beyond the length of the tongue, so that it is necessary to make a reduction in the scale, so as to bring it in on the tongue. Then if we take one-half of $20\frac{3}{4}$, which would be $10\frac{3}{8}$, on the tongue, and one-half of the length of the pitch lines as given, will give the desired cut. Thus for the $\frac{3}{8}$ pitch it would be $10\frac{3}{8}$ on the tongue and $7\frac{1}{2}$ on the blade. The blade giving the cut.

We fancy we hear the critics say, "Why go into all these side cuts of jacks for roofs that are not in style and never will be?" To such our answer is: If you understand the principle of the side cut of the jack for a common square-cornered building, you will understand for the polygonal jacks whether you are ever called upon to frame them or not.

As we write these lines we are reminded of a contractor who had a hexagonal roof to frame. He had a good working force on the job and the time that was lost in help and waste of material would have made a nice profit. Another time a lot of masons were laid off one-half day to give the "Boss Carpenter" time to go to a neighbor-

ing barn where he could have a level floor to lay off a diagram for a full size octagon template for the masons to work by, and yet these men thought they understood the square. They could frame the common hip and valley roof, but when they came to something a little out of the ordinary they did not understand the true principles involved. If these men had possessed a knowledge of the tangents and how to apply them on the steel square, they would have known in a minute's time what figures to use for all of the cuts, lengths and bevels required in the work.

We have seen the carpenter, after cutting and setting the common rafters, climb up the gable and scribe the sheathing boards to the pitch of the rafter instead of using the same figures on the square that he used for the seat and plumb cuts of the common rafter, and yet, he too in his mind knew all about the square and how to frame a roof.

If the first man had possessed a knowledge of the tangents, he would have multiplied the inscribed diameter of the hexagon by 6.93 (6 11-12) and reduced to feet and inches, would have given the length of the sides and all of the cuts and bevels for the roof. The second man should have multiplied his diameter by 4.97 and reduced to feet and inches, would have given the length of the sides of his template. It is the knowledge of such things as these that counts in the race for success, and the day is fast approaching when he

who would be successful in his trade must know the shortest and best methods.

Plumb Cut of Rafter.—In our rounds among the builders, we find that nine times out of ten the boss framer, after laying off the plumb cut

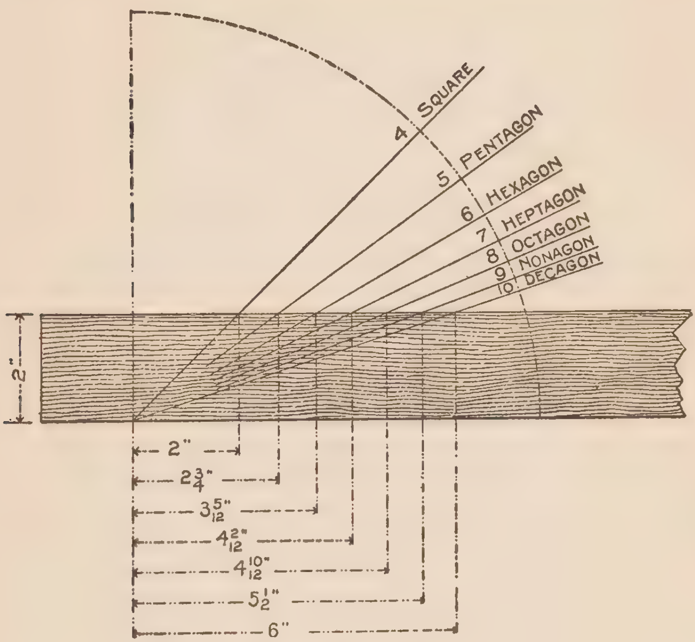


FIG. 231

on the rafter, would take a block cut from the rafter and place it edgewise along with the plumb cut and mark on the opposite side and then diagonally across the top of the rafter to the plumb line on the opposite side and then cut to these lines, which, of course, give correct results for either side cut of jack or hip for the square-

cornered building, but when asked to frame any other than for the square corner, more than likely could not explain and was, so to speak, up against it, because he did not understand the true principle. Yet what is true of the square corner is true of all other angles, which we think will be made clear by referring to Fig. 231. In this we show the angles for the polygons from 4 to 10 and are the same as those shown in Fig. 230, but the cuts are arrived at in a different way.

From this, it will be seen that it is the amount of the base of a triangle whose altitude is equal the thickness of the rafter, that is set off from the plumb cut. In the case of the square building, the base and altitude being equal is the reason that the thickness of the rafter set back from the plumb cut gives the proper angle across the top for the cut. In the illustration we show the amount to set off for the different polygonal jacks.

Octagon Jacks.—In Fig. 232 is shown the application for the octagon jack. The plumb lines A and B remain 4 10-12 inches apart, regardless of the pitch given the common rafter, as will be seen by referring to the elevation in connection with this figure. Here we have the $\frac{1}{2}$, $\frac{1}{4}$ and the level or no pitch. These lines represent the plumb cut on either side of the rafter and by cutting diagonally from one to the other across the back will fit to the side of the hip. It must be remembered that the thickness of the

jack governs the width the lines will be apart. In Fig. 231 the jack is given as being full two inches thick. Hence, for the octagon they are

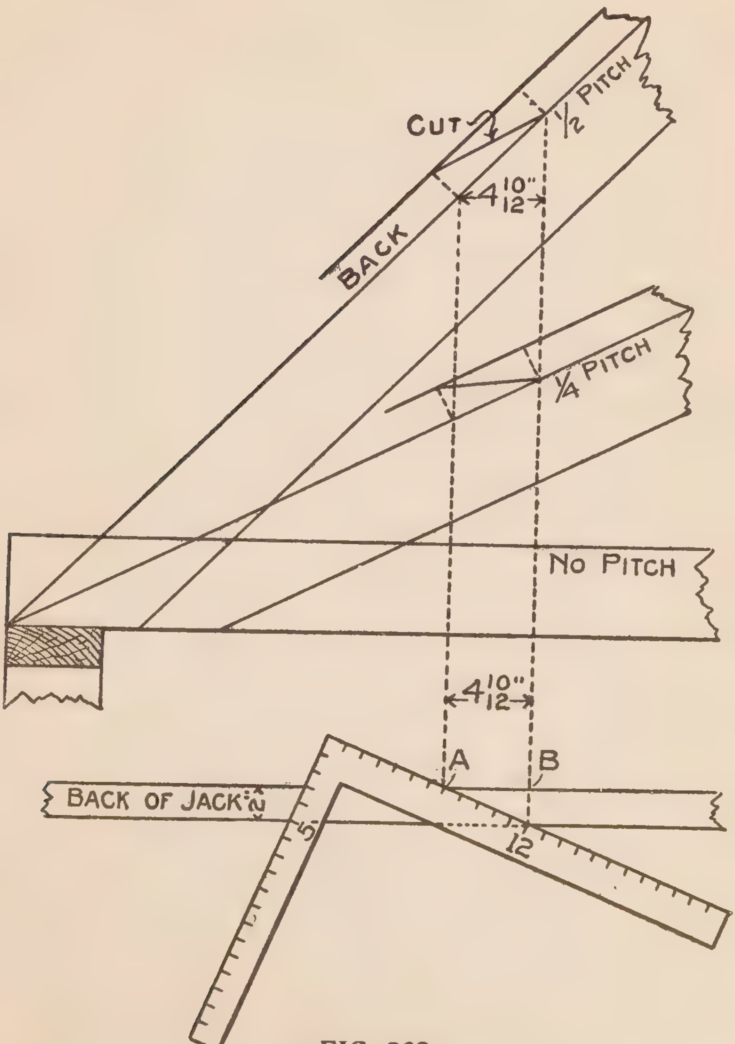


FIG. 232

4 10-12 inches apart. But, after all, we do not get away from the use of the square, as will be seen by referring to the plan in Fig. 232. Here the square is shown applied to the back of the jack with the figures that give the octagon miter and the distance apart of the lines A and B is determined at the point where the blade intersects edges of the rafter, and lines drawn at right angles from these points from the rafter govern the distance apart the plumb lines will be. For any other polygonal jack, proceed in like manner, using the figures on the square that give their miter. The result, however, will be the same as given in Fig. 230, which is much the better system, because it gives the cut direct from the square. However, the formula given in Fig. 231 is worth knowing.

Side Cut of Hip.—In Fig. 233 is shown the companion piece to Fig. 230, and represents the side cut of the hip. A line from 12 to 12 on the blade and tongue represents the run of the hip and its length taken on the tongue and the length of the hip (from 17 to the desired rise on the blade) taken on the blade, will give the correct angle across the top of the unbacked hip. The blade giving the cut.

The first column of figures to the right of the blade represents the length of the hips from a 4 to a 24-inch rise in comparison with the common rafter and are the figures to use on the blade to obtain the side cut. The second column represents the rise in inches to the foot run of

the common rafter, and the third designates the pitch. Inasmuch as the lengths of the hip above the 16-inch rise exceed the length of the blade, it is necessary to reduce the scale. Therefore, the

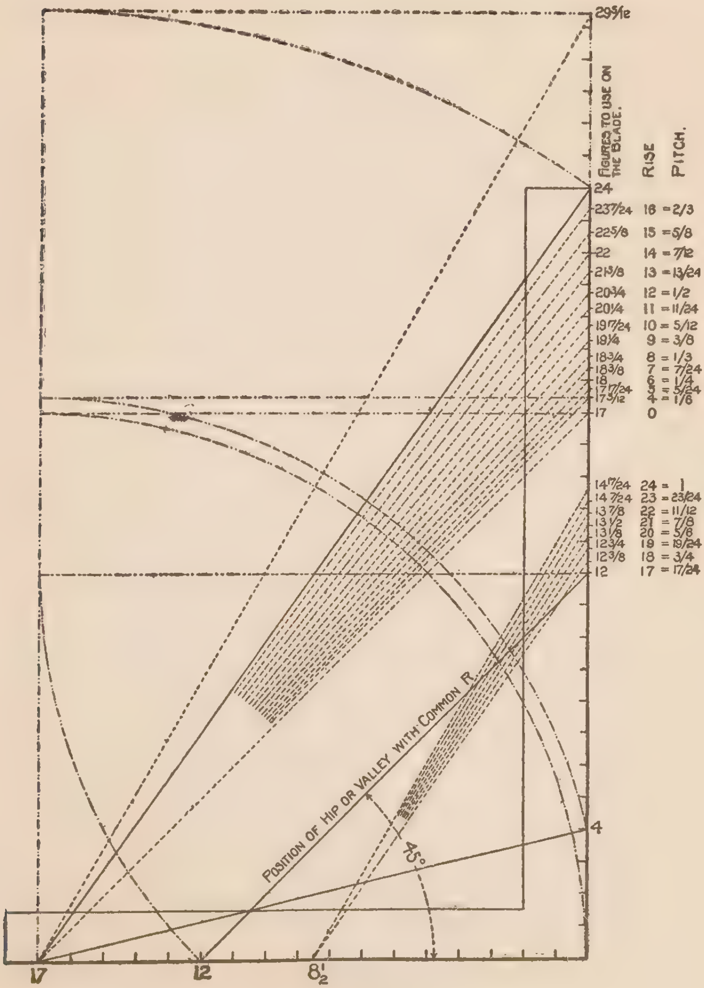


FIG. 233

lines centering at $8\frac{1}{2}$ on the tongue are for the one-half scale. The figures to use on the blade are, therefore, reduced in like proportion to what they would have been in the full scale. However, it must be understood that any figures on the blade and tongue may be used that are in proportion to those used in the full scale. Every fractional mark on the blade represents a scale. Therefore, taking the side of the square that is divided in twelfths there would be $24 \times 12 = 288$ different scales and all giving the same result, but the intersections on the tongue would be in complicated fractions.

Lengths, Cuts and Bevels of Common Rafters.—In Fig. 234 is shown a part of a very convenient table for the length, cuts and bevels for the common rafter up to an 18-foot run and with a rise from 1 to 24 inches to the foot. We have only given the figures for two of the pitches (1-3 and 3-8).

The figures on the blade represent the rise to the foot run. The fractional figures to the left of the blade represent the pitch of the common rafter. The figures on the tongue represent the run in either feet or inches. Therefore, if we wish the length of the common rafter, for a 16-foot span for the $\frac{3}{8}$ pitch, we take one-half of the 16 for the run on the tongue (8) and look in the square opposite $\frac{3}{8}$ and we find 6 feet which represents the rise and 10 feet represents the length of the rafter. If it be an 8-inch run, then the figures found there would represent as many inches.

This table is very convenient in finding the common difference in the length of jacks; as they are but a part of the common rafter, their lengths may be readily found as follows:

If they are spaced one foot from centers, then the length of the first square will be the common

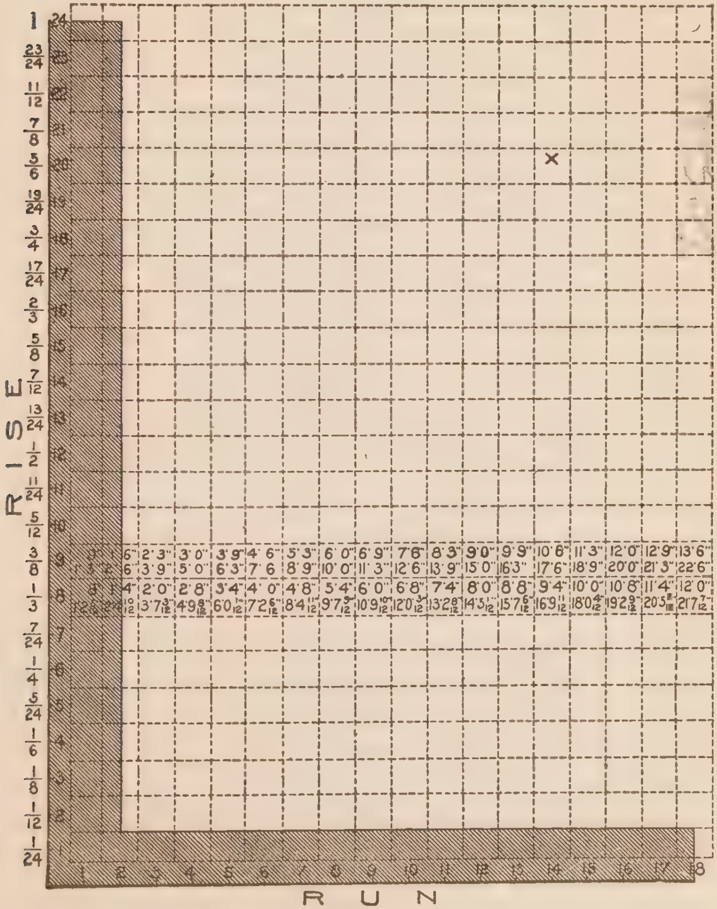


FIG. 234

difference. The length of the second jack will be that found in the second square, and that for the third will be found in the third square, etc. If the jacks are spaced on 24-inch centers then find the lengths in every other square. If they be placed on 16-inch centers, look under the 16th run and consider the length found there as inches. If they be placed on 18-inch centers, look under the 18th run, etc.

There are twelve scales in this table. Each figure in the run representing a scale and all giving the same cuts. Thus, the seat and plumb cuts for the common rafter are as follows:

Take the number of any run on the tongue and its rise found in the square above and opposite the desired pitch, on the blade will give the seat and plumb cuts. Take the number of any run on the tongue and the corresponding length of the rafter on the blade will give the side cut of the jack and also the face cut across the roof boards to fit in the valley or over the hip. The blade giving the cut on the former and the tongue in the latter.

Take the length of the rafter for any run on the blade and its rise on the tongue and the latter will give the miter cut across the edge of the roof boards, which is the same as the miter for the square hopper. The figures for the full scale are found in the twelfth run for the above cuts as before illustrated.

To Find the Side Cuts for the Polygonal Jacks.—Take the tangent on the tongue (see Fig. 230)

and the length of the common rafter found in the twelfth run on the blade and the latter will give the cut.

Lineal Board Measure.—This table also contains a complete lineal board measure for any width of board up to 18 inches, as follows:

Let the figures on the tongue represent the width of the board and those on the blade the length. The top figures in the intersecting squares opposite these numbers will be the contents of the board in feet and inches, as follows:

A board 6 inches wide and 9 feet long contains 4 feet 6 inches. A board 17 inches wide and 9 feet long contains 12 feet 9 inches. A board 15 inches wide and 8 feet long contains 10 feet, etc. A board 14 inches wide and 20 feet long, the answer would be found in the intersecting square opposite the starting points, as at X. Thus it will be seen that a completed table of this kind would come very handy as a ready reckoner. The reader will notice in the $\frac{3}{8}$ pitch that the lengths are without fractions. This occurs at three places on the blade—5, 9 and 16, respectively. Thus in the 1-3 pitch, the lengths end in fractions and are expressed in twelfths. For an 8-foot run the length would be 8 feet 7 5-12 inches. For an 8-inch run the 5-12 may be discarded as it represents less than half of a twelfth of an inch. The answer would then be 9 7-12 inches.

Length of Rafters for Odd Runs.—We wish to call special attention to the table at Fig. 234, in

the convenience of same for finding the lengths of rafters for odd runs, such as feet, inches and fractions of an inch in the run, as the figures stand for either feet, inches or fractions of an inch. The fractions being expressed in the same denominations (twelfths), permits of a sliding scale, as follows: for an example, suppose the run is six feet and one-half inches with a one-third pitch. In the intersecting square opposite the rise and run, we find seven feet two and six twelfths which answers for the six feet. For the six inches in the run, read the above figures as so many inches and twelfths of an inch, and for the half-inch, read the above figures again as so many twelfths and fractions of a twelfth of an inch. The whole may be expressed thus:

For the six feet . . 7 feet 2 and 6-12 inches
For the six inches . . . . . . 7 and 2-12 inches
For the six-twelfths . . . . 7-12 inches

Answer . . . . . 7 feet 10 and 3-12 inches

Then 7 feet 10 3-12 inches is the correct length. The last two figures (8 and 6) are dropped because they represent too small a denomination to be retained. Remember these figures represent twelfths (not tenths) and we only carry to the next column when the sum exceeds twelve, otherwise the operation is just the same as in simple addition. If the run was, say 5 feet 7 and 9-12 of an inch, the figures would be expressed thus:

For the five feet . . . . . 6 feet and 1-12th inches
For the seven inches . . . . 8 and 4-12 inches
For the nine-twelfths inch . . . . 10-12 inches

Answer . . . . 6 feet 9 and 4-12th inches

Then 6 feet 9 and 4-12 inches would be the correct length for the common rafter. This may seem like getting the lengths and cuts down to a small point. So it is. To many it may seem useless. In this, we have been accused of splitting hairs, but we would rather see split hairs than see rafters wedged up with a "dutchman" and with gaping joints at the bearings, for what is the use of using good material and leaving yawning joints with the bearings oftentimes at the tip ends of the rafters where the wood is thin and this cut to pieces with nails in the vain effort to make it "good enough?" If we make poor joints why not use poor lumber? Sorry to say we are forced sometimes to use poor lumber, but there is no occasion for poor joints. Make the cuts to get the full bearings and thus save all the strength there is in the material in bracing power. This table refers only to the rise and length of the common rafter. It could be so enlarged as to include the corresponding octagon hip and common hip or valley, thus making a very handy table for ready reckoning purposes.

In Fig. 235, we show how all of the lengths, cuts and bevels may be obtained from the triangle, bounded by A-B-C, formed by the runs of the common and hip rafters and the tangent, as

shown at No. 1, as follows: From the run of the common rafter, erect the desired rise as at A-D

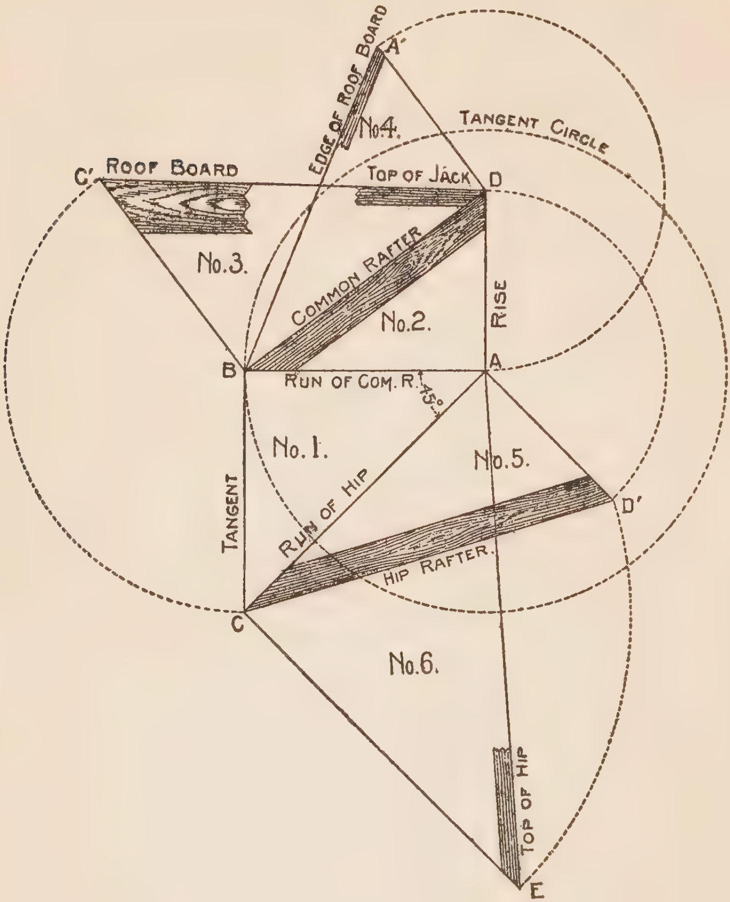


FIG. 235

and connect D-B. This forms the second triangle and contains the length, seat and plumb cuts of the common rafter, as shown in No. 2. At right

angles from the common rafter draw a line equal to the tangent as $B-C^1$ and connect $D-C^1$. This forms the third triangle, as shown in No. 3. In this are shown the face cut of the roof boards to fit in the valley or over the hip. This angle also gives the cut across the back of the jack to fit against the hip or valley, commonly called side cut of the jack. At right angles from the common rafter draw a line equal to the rise as $D-A^1$ and connect $B-A^1$. This forms the fourth triangle, as shown in No. 4. In this is shown the edge or miter cut of the roof boards to fit in the valley or over the hip. In other words, this is the same as the miter for a hopper. Now then, we will work from the other side of triangle No. 1. From the run of the hip draw a line at right angles from A-C equal to the rise, as at $A-D^1$ and connect $C-D^1$. This forms triangle No. 5, and contains the length, seat and plumb cuts of the hip. From hip rafter and at right angles to A-C draw a line equal to $C-D^1$ as C-E and connect A-E. This forms triangle No. 6 and in it is contained the top or, commonly called, the side cut of the hip. The illustration is for the 3-8 pitch or 9 inches rise to one foot run of the common rafter. For an octagon roof the angle at No. 1 would be $22\frac{1}{2}$ degrees. For a hexagon roof it would be at 30 degrees.

In Fig. 236 are shown all of the above angles formed by as many steel squares, with the corresponding numbers placed on same that help to form two of the sides of each angle, and, by referring to the preceding illustration, the reader can

readily see how the cuts are obtained on the steel square.

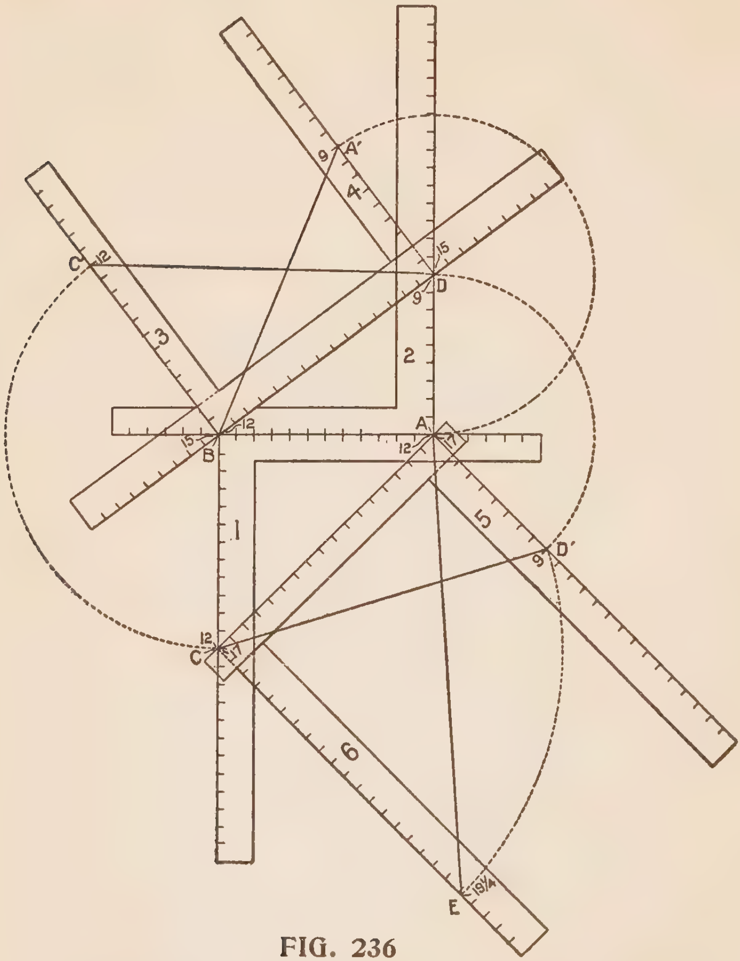


FIG. 236

Developing Cuts and Bevels.—Illustrating the cuts and bevels with the triangle is probably the most practical way of showing the various cuts

contained in and about the roof, regardless of its shape or pitch given the rafters, as by its manipulation all of the angles can be obtained. The steel square serves as the triangle, the blade and tongue forming two of the sides (run and rise)

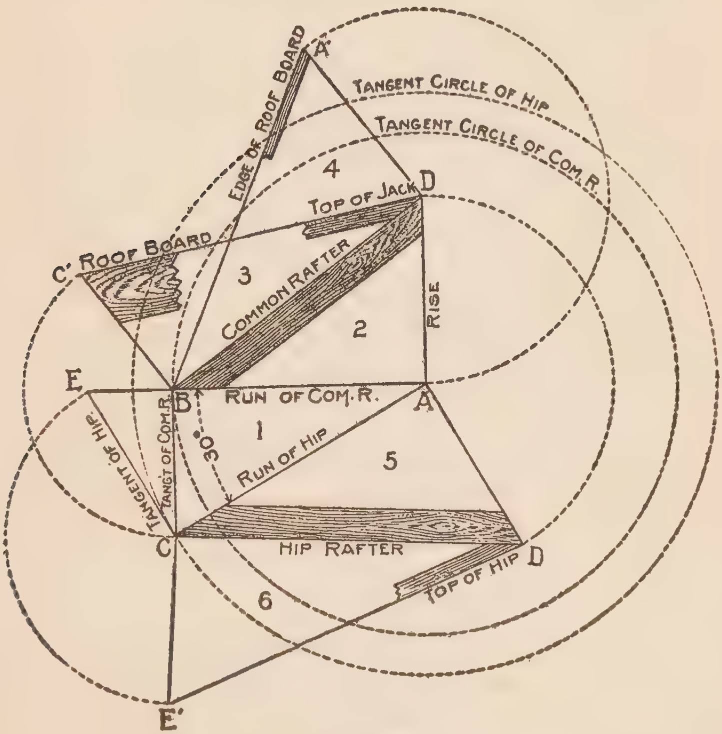


FIG. 237

and these, applied to the pitch given the rafter, form the third side, or if it be for a miter, then the angle in degrees of same from the starting point from the surface cut will give the proper angle to obtain the cut.

In Fig. 237 are shown the triangles for a hexagon (six sided) roof and by comparing with the preceding illustrations, the reader can see wherein they differ. The application is the same except in the sixth angle. Angle No. 1 represents the plan and governs the layout of the diagram. In

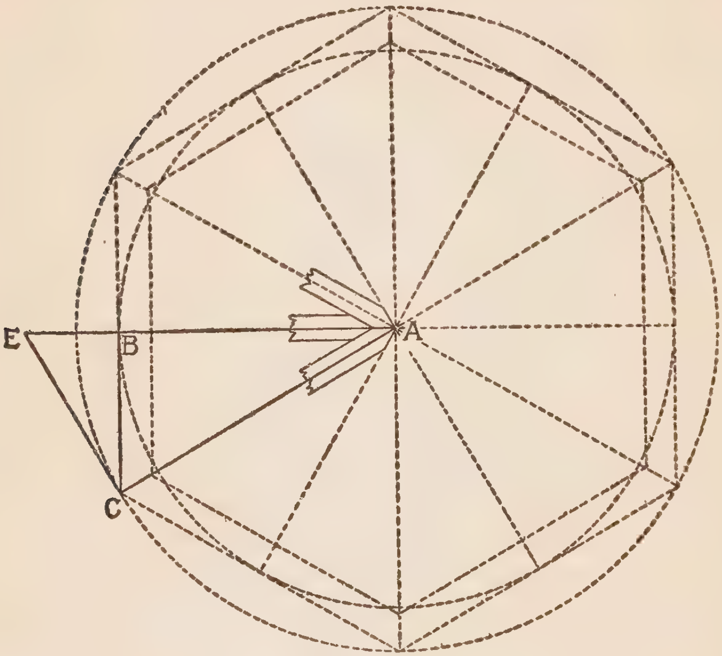


FIG. 238

this, the angle between the runs of the common rafter and the hip is at 30 degrees. Now, by referring to Fig. 238, we show the angle bounded by A-B-C as shown at No. 1 applied to the plan of the roof as follows:

A-B run of the common rafter. A-C run of

the hip. B-C tangent of the common rafter. Now by extending A-B intersecting a line at right angles from A-C as at E, then E-C will represent the length of the tangent from the hip. Note:— See the difference in length when compared with the run of the hip.

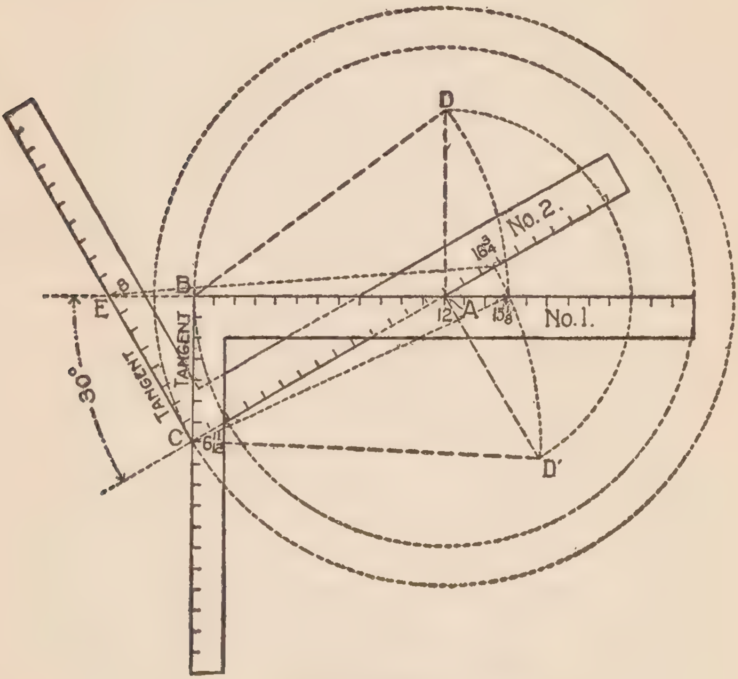


FIG. 239

In Fig. 239 is shown how these angles may be obtained with the aid of two steel squares. It may be worked to a scale of one inch to the foot, or full scale for a one-foot run of the common rafter, as shown in the illustration. The figure on the tongue that gives the hexagon miter

(6 11-12) represents the tangent for the common rafter as shown on square No. 1, and by placing square No. 2 with its heel resting at 6 11-12 and with the blade intersecting at 12 on square No. 1, then a line continued from the heel of square No. 1 and in line with the blade intersecting the tongue of square No. 2, which in this case is at 8 and represents the tangent for the hip. Now by erecting the rise from the intersection of the blades to D and D′, then B-D represents the length of the common rafter and D′-C that of the hip and these lengths, taken on the blade of the respective squares, will give the figures to use for the side cuts of the rafters. Thus—6 11-12 and 15 1-8 as shown, will give the side cut of the jack, or of the common rafter, to fit in the angle between the hips at the peak (see Fig. 238) and 8 and 16 3-4 will give the side cut of the unbacked hip to fit in the peak, or if it is first backed, then the same figures as shown on square No. 1 applied to the backing plane will give the same result. But, of course, this is not practical because the ends of the hip would run to a feather edge, as shown. A better way is to insert a hexagon block with sides equal the width of the hip, then the cut of the hip would simply be the plumb cut. This would afford a better nailing space and each hip would have a direct bearing against the one on the opposite side.

Seat and Plumb Cuts.—In Figs. 230 and 231 are illustrated the side cuts of polygonal jacks and to complete this line of work, we show in

Fig. 240 the accompanying illustration of the seat and plumb cuts for the corresponding hips and valleys. Beginning at horizontal line, which represents the run of the rafters, then 12 and 9

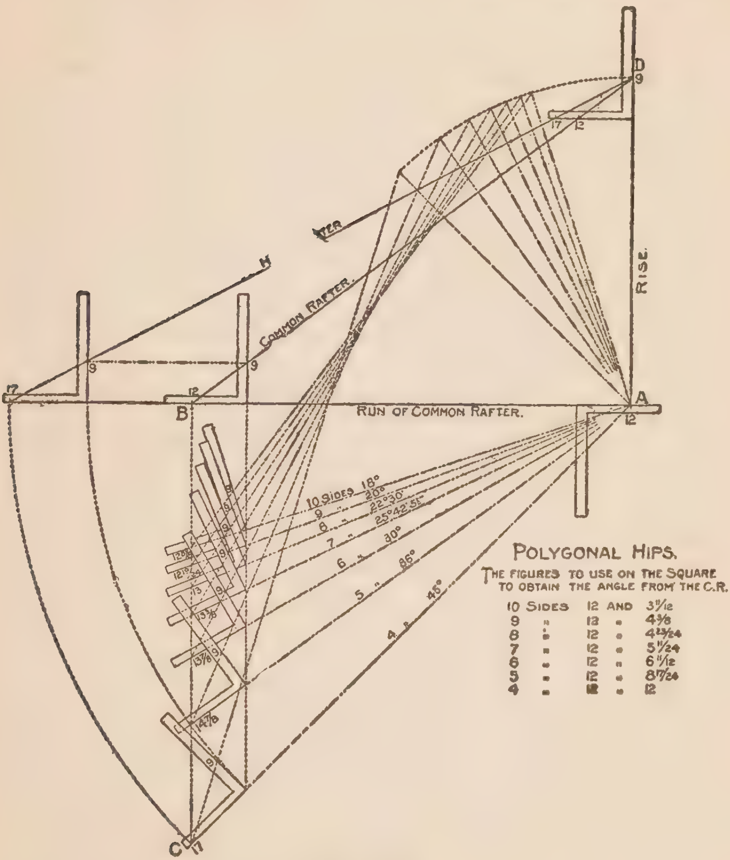


FIG. 240

on the steel square represent the cuts for the common rafter for the 3-8 pitch. The steel square just beneath the horizontal line and with the

12-inch mark on the tongue resting at the rise, locates the angle of the respective runs with that of the common rafter and the figures to use on the blade of the square are the same as those used for the polygonal miters and as shown in the table. It will be seen, the vertical line dropping from 12 on the tongue of the steel square at the seat cut of the common rafter, as at B, and where the same intersects the figures on the tongue of the squares resting just beneath on the individual runs, gives the figures to use on that member for the cuts. The rise being the same as the common rafter, we use the same figures on the blade, as will be seen by referring to the illustration. Now if the runs of the hip were pivoted at the point of the rise, as at A, and we could raise them up until they rest on the horizontal line, it would be found that the pitch lines would center at one point at the top, as at D, and they would all fall in between 12 and 17 on the tongue and center at 9 on the blade. The figures on the tongues of the squares would remain as shown for the seat cut. If there was no pitch given to these rafters, then the corresponding figures that give the polygonal miters would give the side cut of the hip, though the cuts on the square would be reversed.

Part IV

RULES AND EXAMPLES. To lay off an octagon — To lay off a hexagon — To make an ellipse — To make an oval — To bend a board for a circle — To find the number of courses of shingles for a roof — To draw a polygon in a given circle — To divide a circle into any number of equal parts — To cover a circular dome — To cover a conical roof — To kerf a board to bend to a given circle — The protractor.

Rules and Examples.

Fig. 241 shows how **to lay off an octagon on the end of a timber.** Lay the square on the line drawn from corner to corner, a distance equal to half the width of timber, square over, and you have one corner. Turn the square over and you have another, etc. The lower square at bottom illustrates the octagon miter, which is 10 and 24; cut on 10. The octagon corner is a square miter; that is, if you cut timber to lap on octagon corner they are cut on 12 and 12, or square miter.

If you wish **to miter a pentagon,** place the square on $8\frac{3}{4}$ and 12; cut on $8\frac{3}{4}$.

To Lay Off a Hexagon.—Fig. 242 illustrates a hexagon. To lay off from a square timber divide two opposite sides into four equal parts and the other two sides into two equal parts. A circle can be laid off into a hexagon the same way, as can be plainly seen in the illustration. The hexagon miter is 8 and 14, cut on 8. The corner is the same.

Fig. 243 illustrates **laying off a stair,** and needs no further explanation.

Fig. 244 is an illustration of **a good method of cutting bridging.** If the joists are 8 inches wide

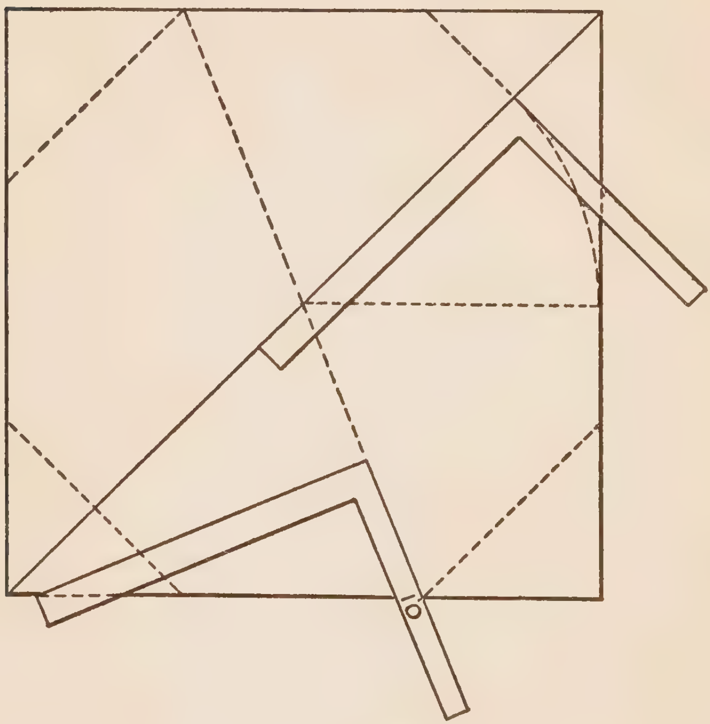


FIG. 241

and 16 inches centers, there will be 14 inches between. Place the square on 8 and 14, and cut on 8, and you have it. The only point to observe is that 8 is on the lower side of the piece of bridging while the 14 is on the upper, and not both on same side of timber, as in nearly all work.

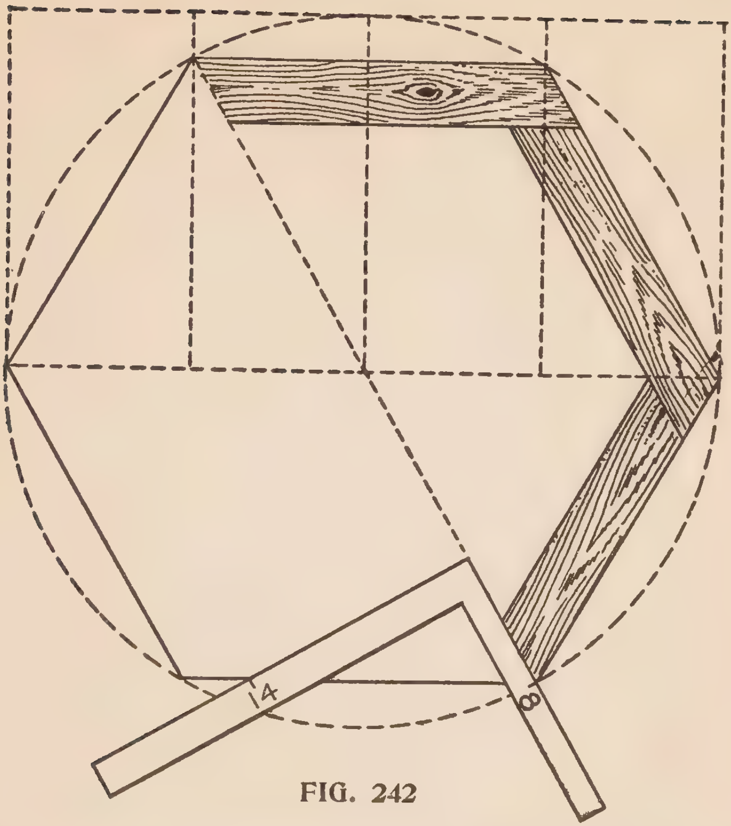


FIG. 242

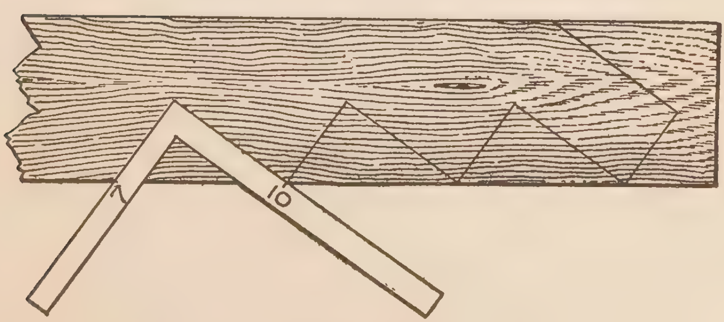


FIG. 243

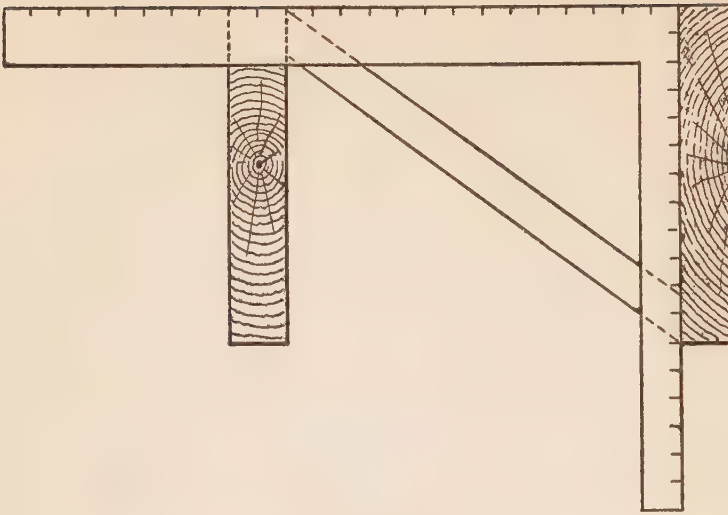


FIG. 244

To Make an Ellipse for a three-foot opening, one foot high, drive a brad in a lath one foot from end, which gives height; another 18 inches from

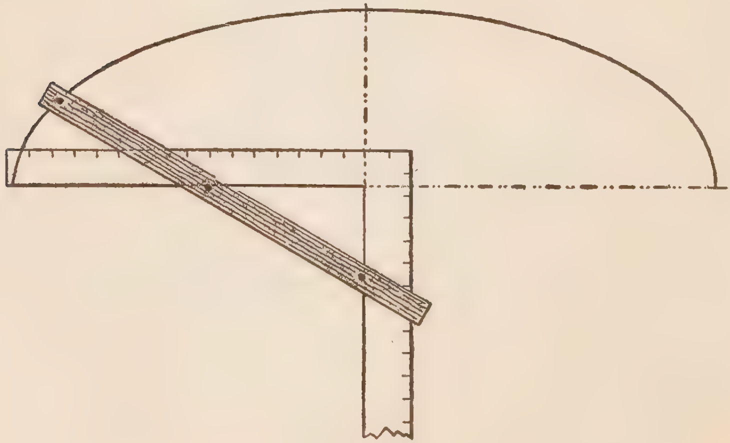


FIG. 245

end, which gives one-half width. Apply as illustrated in Fig. 245, reverse the square and it is completed.

Fig. 246. **To Make an Oval** begin same as on ellipse, swing around on the one brad, which

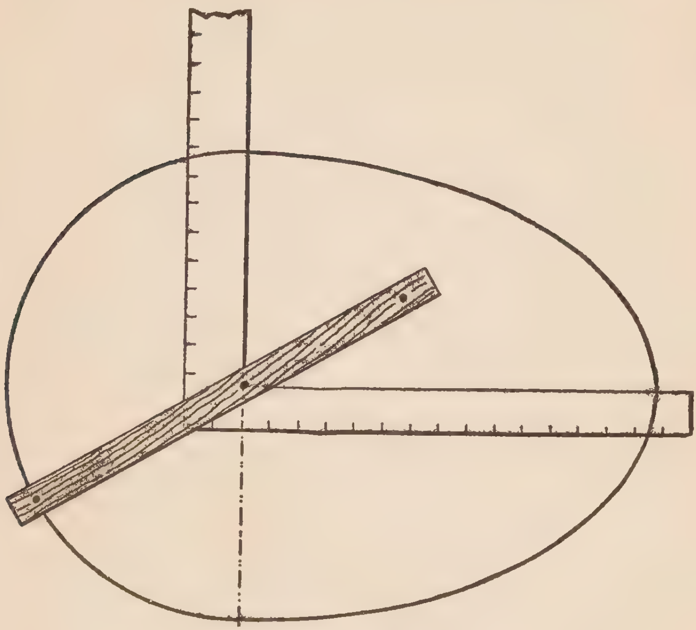


FIG. 246

will make a circle on the large end, and it is formed as illustrated.

Fig. 247. **To Bend a Board for a Circle,** if the given length is two feet saw in and bend the board up until the joint is closed. If the saw is very coarse it will raise at end about two inches. Therefore, saw in every two inches.

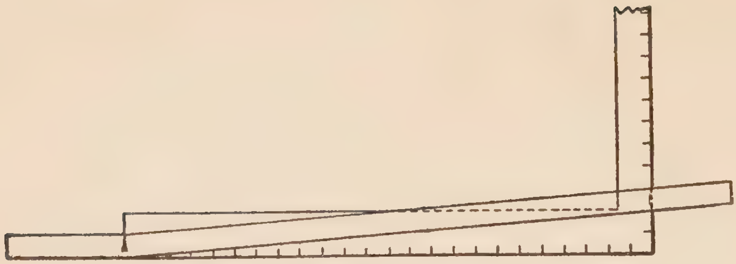


FIG. 247

Fig. 248. **To Find the Number of Courses of Shingles for a Roof.**—If there were four inches to the weather it would be three to the foot, and very easy. Therefore, to get any number practically as easy, is the point. If 4½ inches, two courses would be 9 inches. To get one foot length and only 9 inches actual measurement, place one

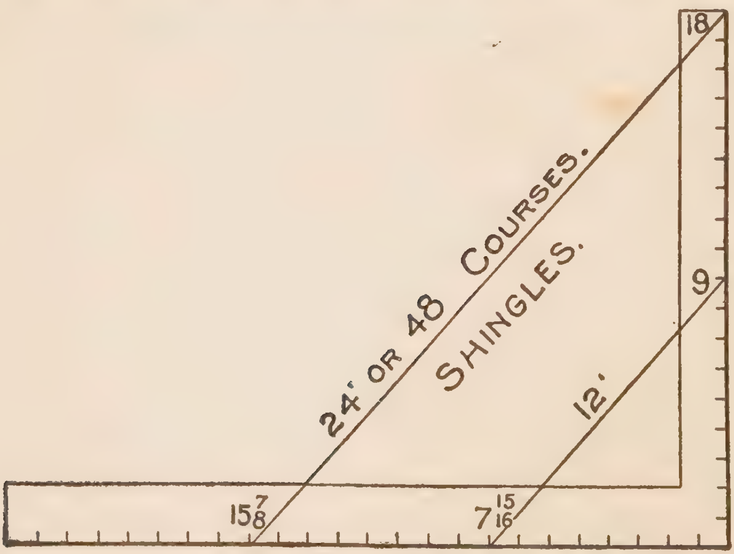


FIG. 248

foot at 9, swing around until the other end of the foot strikes the square, which is at 7 and 15-16. If the roof is 18 feet, measure from 18 parallel with the line just made, and it strikes the square at 15 and 7-8, and the line from 18 to 15 and 7-8

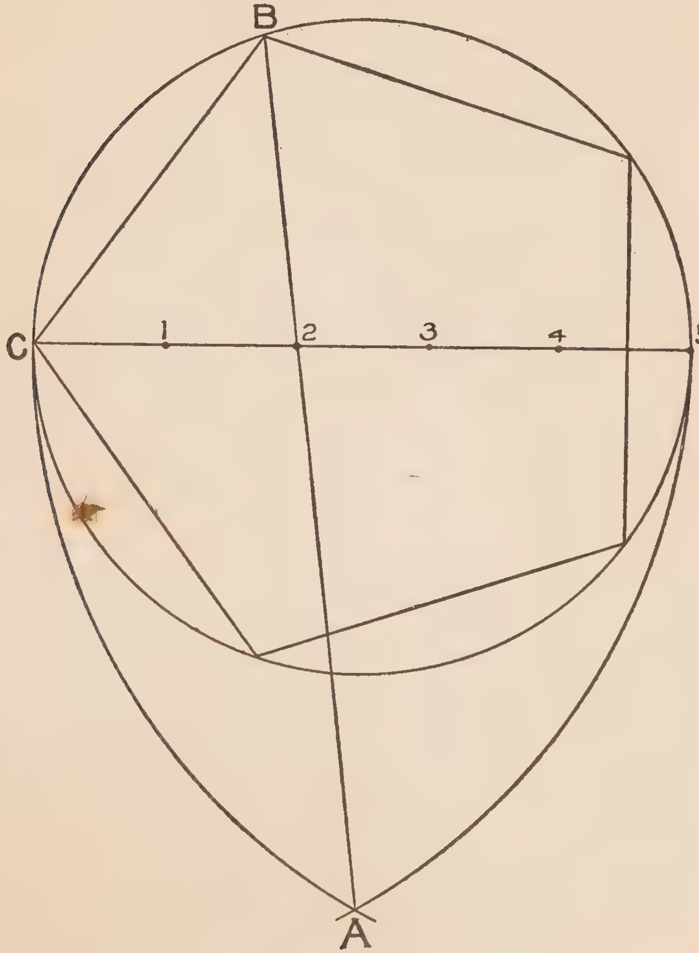


FIG. 249

is 24; two courses to every foot diagonal measurement gives 48 courses. This may seem a little complicated at first, but when it is fully understood it can be applied instantly. Any numbers can be applied the same way.

All of the foregoing problems given by Mr. Dwight L. Stoddard are useful and can be readily understood.

To Draw a Polygon in a Given Circle.—Divide the diameter of a circle into the number of parts that there are sides in the desired polygon, and with a radius equal to the diameter of the circle describe arcs cutting at A (Fig. 249). From A

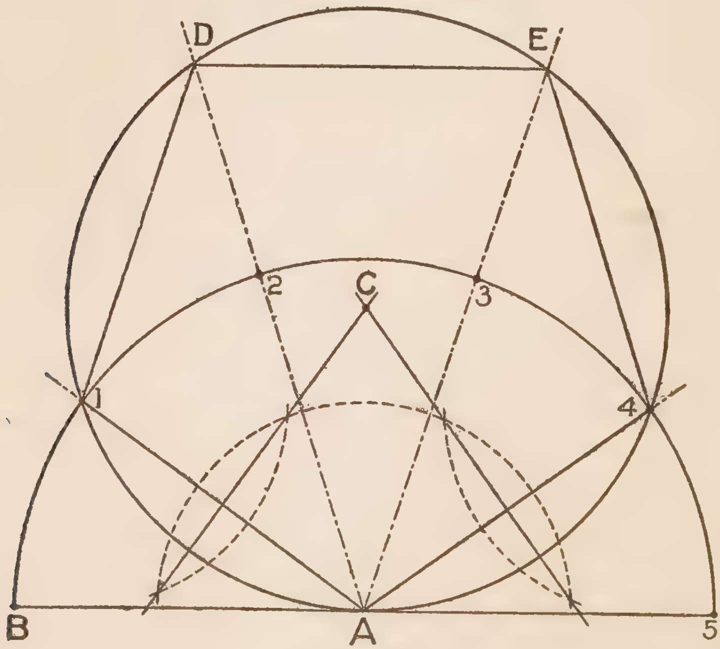


FIG. 250

produce a line, always passing through the second division of the diameter and extend until it cuts the circle, as at B. Then from B to C will equal the length of one of the desired sides of the polygon, from which the other sides can easily be spaced. The illustration shows a pentagon or five-sided figure.

To Draw a Polygon when the Length of the Side is Given.—Let the radius of a semicircle equal the length of the desired side of the polygon, as from A to B, and divide the semicircle into the number of parts desired in the polygon, as shown in Fig. 250. Produce lines from A through all of the points on the semicircle and bisect the two lower of these lines as shown will locate the center as at C. Then with C-A as radius describe a circle which will be the circumscribed diameter of the polygon. Then by connecting the points 1, D, E, etc., on the circle, the polygon will be complete.

To Divide a Given Line Into Any Number of Equal Parts.—Let A-B (Fig. 251) be the given line to be divided into five equal parts. From the point A draw the straight line A-C, forming any angle with A-B. On the line A-C, with any convenient opening of the compasses, set off five equal parts towards C; join the extreme points C-B; through the remaining points 1, 2, 3 and 4, draw lines parallel to B-C, cutting A-B in the corresponding points 1, 2, 3 and 4; A-B will be divided into five equal parts, as required.

There are several other methods by which

lines may be divided into equal parts; they are not necessary, however, for our purpose, so we will content ourselves with showing how this

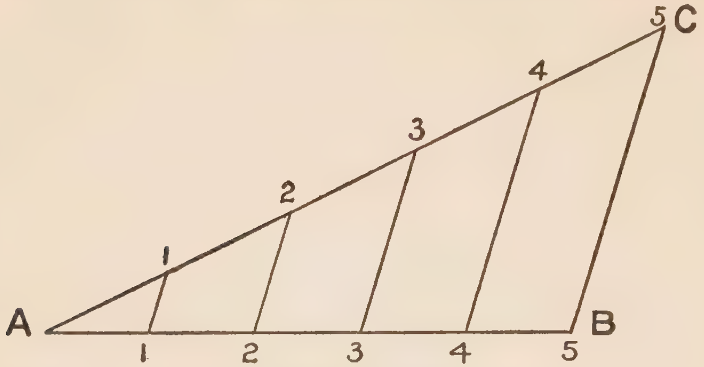


FIG. 251

problem may be used for changing the scales for drawings whenever such change is desired. Let A-B (Fig. 252) represent the length of one scale or drawing, divided into the given parts Ad, de,

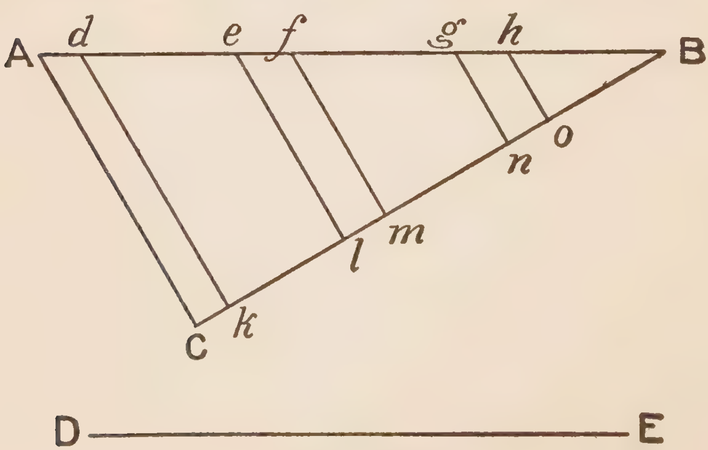


FIG. 252

ef, fg, gh and hB; and D-E the length of another scale or drawing required to be divided into similar parts. From the point B draw a line B-C= D-E, and forming the angle with A-B; join A-C, and through the points d, e, f, g, and h, draw dk, el, fm, gn, ho, parallel to A-C; and the parts Ck, kl, lm, etc., will be to each other, or to the given line D-E, as Ad, de, etc., is to A-B. By this method, as will be evident from the figure, similar divisions can be obtained in lines of any given length.

To Divide a Given Circle Into Any Number of Equal or Proportional Parts by Concentric Divisions.—Let A-B-C (Fig. 253) be the given circle,

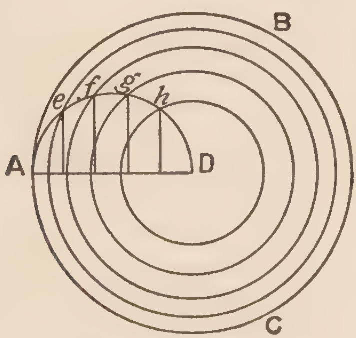


FIG. 253

to be divided into five equal parts. Draw the radius A-D and divide it into the same number of parts as those required in the circle; and upon the radius thus divided describe the semicircle: then from each point of division on A-D, erect perpendiculars to meet the semi-circumference in

e, f, g and h. From D, the center of the given circle, with radii extending to each of the different points of intersection on the semicircle, describe successive circles, and they will divide the given circle into five parts of equal area as required; the center part being also a circle, while the other four will be in the form of rings.

To Divide a Circle Into Three Concentric Parts, bearing to each other the proportion of one, two, three, from the center.—Draw the radius A-D (Fig. 254) and divide it into six equal parts.

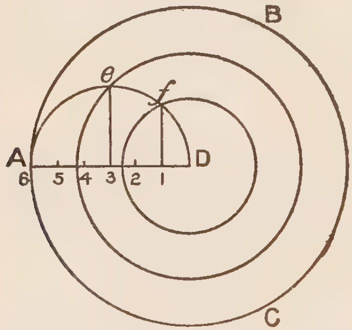


FIG. 254

Upon the radius thus divided describe the semicircle; from the first and third points of division draw perpendiculars to meet the semi-circumference in e and f. From D, the center of the given circle, with radii extending to e and f, describe circles which will divide the given circle into three parts, bearing to each other the same proportions as the divisions on A-D, which are as 1, 2 and 3. In like manner circles may be divided in any given ratio by concentric divisions.

To Cover a Circular Dome with Horizontal Boarding.—Proceed as follows: Let A-B-C (Fig. 255) be a vertical section through the axis of a circular dome, and let it be required to cover this dome horizontally. Bisect the base in the point

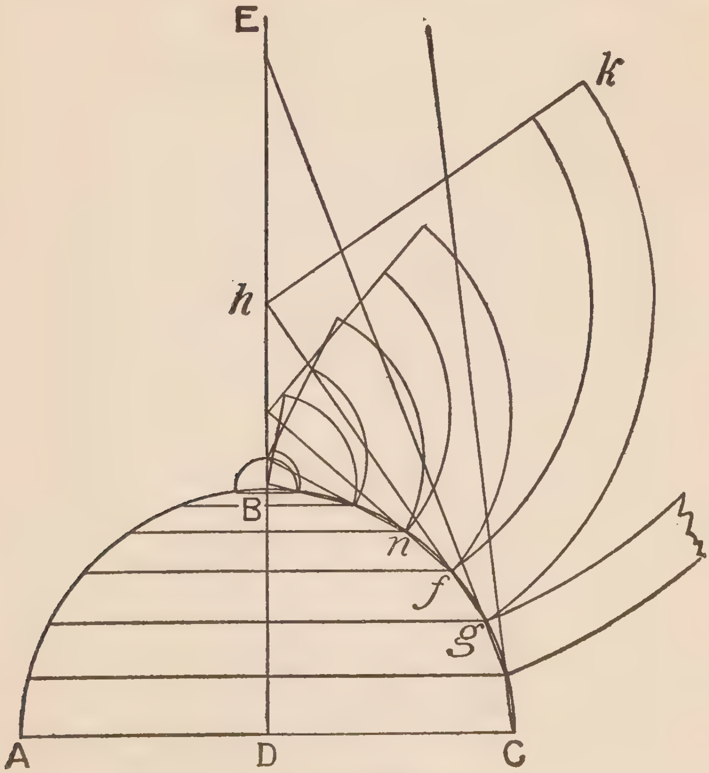


FIG. 255

D, and draw D-B-E perpendicular to A-C, cutting the circumference in B. Now divide the arc B-C into equal parts so that each part will be rather less than the width of a board, and join

the points of division by straight lines, which will form an inscribed polygon of so many sides, and through these points draw lines parallel to the base A-C, meeting the opposite sides of the circumference. The trapezoids formed by the sides of the polygon and the horizontal lines may then be regarded as the sections of so many frustums of cones, whence results the following mode of procedure: produce, until they meet the line D-E, the lines nf, fg, etc., forming the sides of the polygon. Then to describe a board which corresponds to the surface of one of the cones, as fg, of which the trapezoid is a section, from the point h, where the line fg produced meets D-E, with the radii hf, hg, describe two arcs, and cut off the end of the board k on the line of a radius hk. The other boards are described in the same manner.

To Cover a Circular Dome with Vertical Boarding.—The upper part of Fig. 256 represents the elevation of the dome, and the lower part represents the plan and the shape of the board in the stretch-out. Divide the diameter of the dome into spaces equal the width of the boards to be used. Divide one side of the elevation into any number of equal parts, as 1, 2, 3, etc., and from these points draw parallel lines down to the diameter of the plan as at C″B″. From C″ as a center draw lines C″D and C″E which represents the board in its respective place on the dome. From C″ as center and with the points 1, 2, 3, etc., on the diameter swing around to C″D and

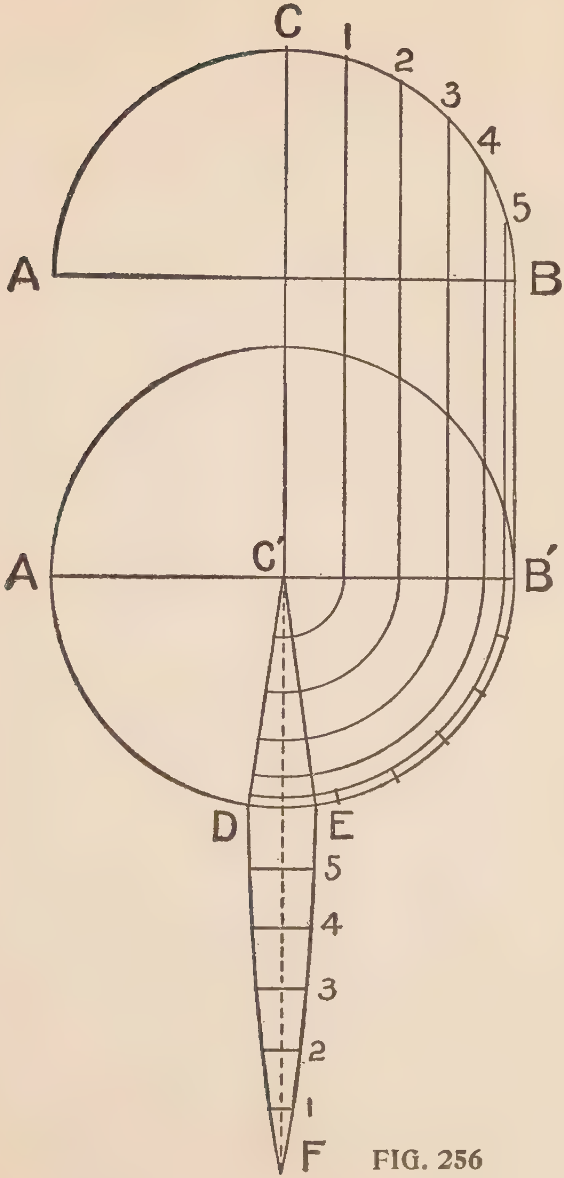


FIG. 256

C″E as shown; and on the line C″F lay off the distance 5, 4, 3, etc., which will be the correct length or stretch-out of the board. The length of the cross lines between C″D and C″E governs the length of the cross lines of the board. Care should be taken to not have the boards too wide, as the narrower the boards the better they will fit the dome.

To Cover a Conical Roof with Vertical Boarding.—This is a form quite generally used for the sheathing of tower roofs, and the illustration (Fig. 257) needs but little explanation. As in the former figure the upper part of this illustration represents the elevation, and the lower part the plan. The elevation shows the frame work of the rafters with the cross pieces in between the same.

With A as a center and with the length of the rafter as a radius describe an arc, as at B-C, which will represent the bottom end of the roof boards, and on this lay off the described width of the boards to be used, as at B-D, and connect D with A. Then A-B-D will be the correct shape of the board. The cross pieces between the rafters are found as shown in the plan at 1, 2, 3, etc.

Fig. 258 shows the **manner of finding proportions of a small moulding which is required to miter with a larger one or vice versa.**—Let A-B be the width of the larger moulding, and A-D the width of the smaller one; construct with these dimensions the parallelogram A-B-C-D, and draw its diagonal A-C. Let A-B be the section of

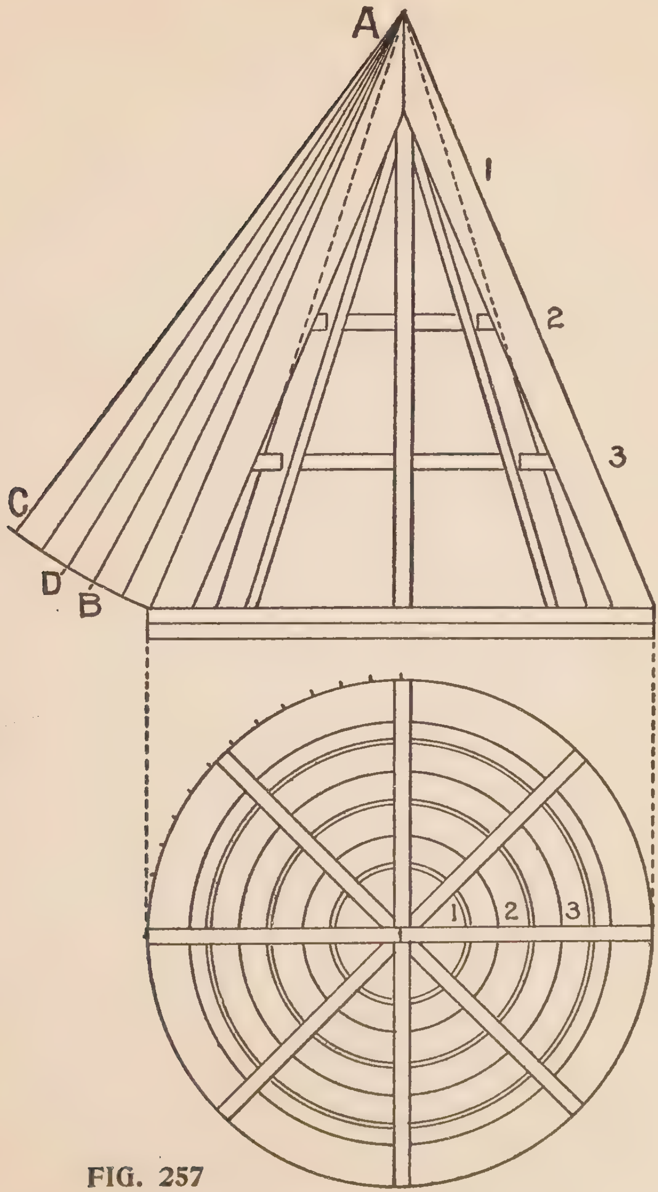


FIG. 257

the moulding which we wish to reduce to member with a moulding the width of A-D. Draw any number of parallel lines to B-C, cutting the line

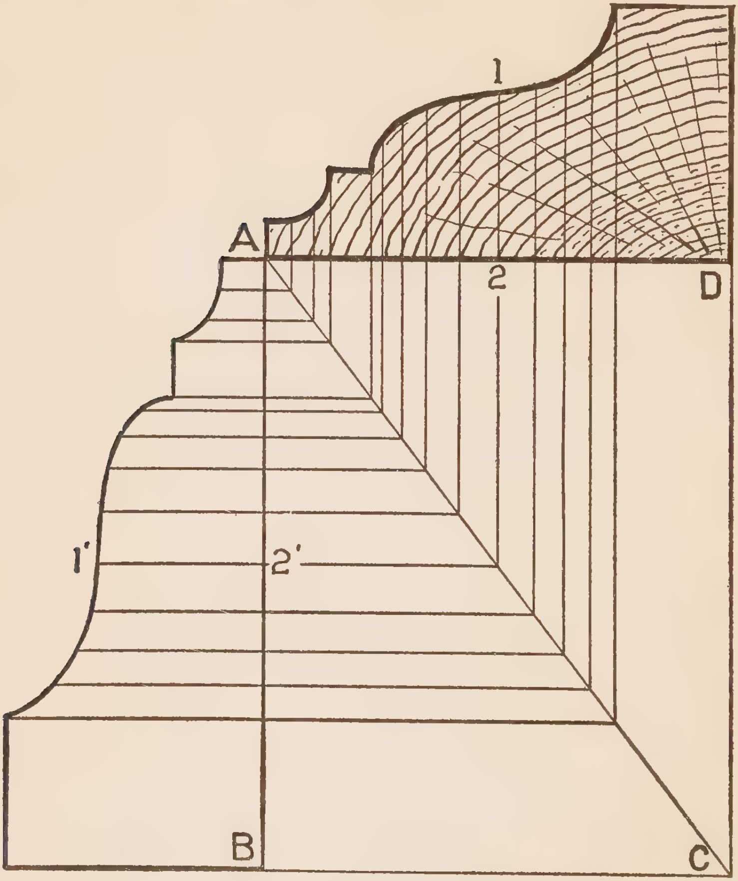


FIG. 258

A-C, from which points draw lines parallel to D-C and beyond the line A-D. From the latter set off the thickness of the moulding on the cor-

responding lines, as $\frac{1}{2}$ will give the contour of the mould for the lesser width or vice versa.

To Kerf a Board to Bend to a Given Circle.—Suppose the radius of a circle to which we wish to bend the board to be three feet, as shown in Fig. 259. Take a piece of the board which we wish to bend and with the saw make a kerf about three-quarters the way through, being careful to cut to the same depth on both edges, and place

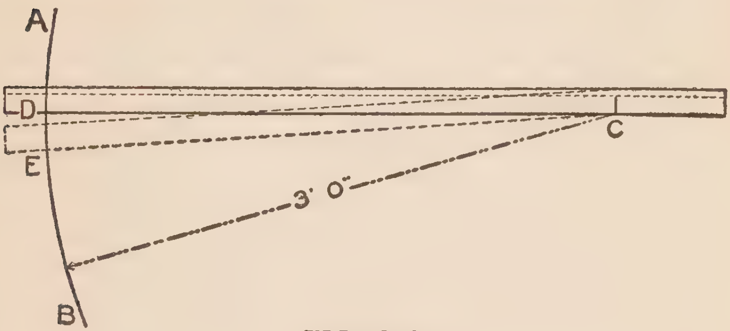


FIG. 259

the board along the line C-D with the kerf at the center as at C. Spring the board until the kerf is closed and the distance the straight edge of the board has moved along the line of the arc A-B will be the proper distance to make the kerfs as at E-D.

The Protractor.—In Fig. 260 we show a scale of degrees, commonly called a protractor. This we believe will be found quite convenient to the woodworker in general, because any angle may be obtained from it by simply placing the bevel to the lines as shown, and as it is the degrees that

determine the angles, any of the regular polygonal miters may be accurately found by setting the bevel to the angle of their miters. Thus the angles of the square figure are 90 degrees and the miter must necessarily stand at one-half that, or 45 degrees. The angles of the equilateral triangle are 60 degrees and the miter is 30 degrees.

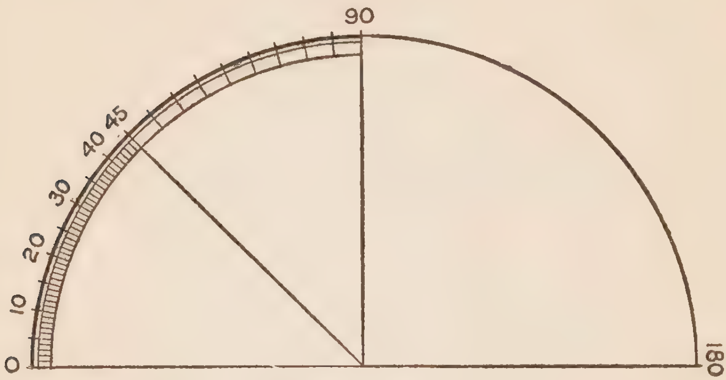


FIG. 260

The angles of the hexagon are 120 degrees, the miter is 60 degrees, etc. The reader will notice that only one-half of the protractor is divided into the degree divisions. The reason for this is that it is sufficient to obtain any angle desired.

Part V

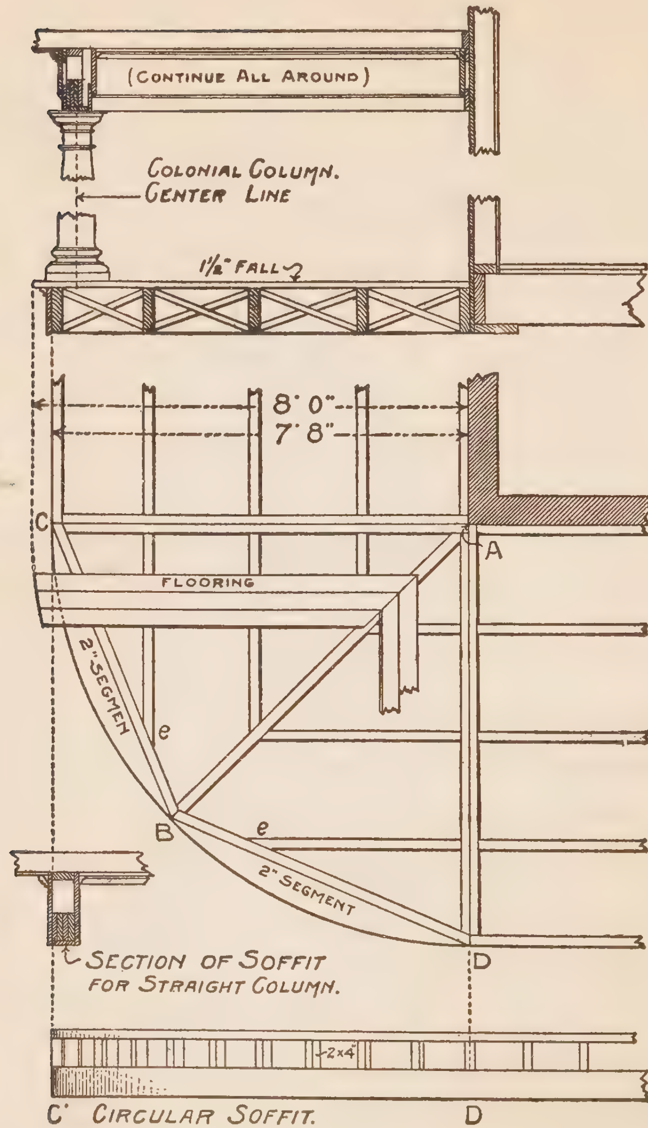
QUESTIONS AND ANSWERS. Framing a circular porch — End cut of hip to rest on adjoining roof — Cutting rafters — How to find length of hip rafters — Seat and plumb cut of hood rafters — Side cut of the hip — How to cut a hip rafter — A square pitched roof — Miter cut on a moulding — Length and cuts of hip rafters — To square a tapering timber — Explaining board measure — Framing a gambrel roof — Side cut of the jack — Lenght of hip rafter — How to find length of brace — Fitting a hip jack — Miters for uneven pitches — Valley cuts of planceer —Exact lenght and cut of valley — Regular and irregular rafters.

Framing a Circular Porch.

Question: Can you tell me the best way of framing a circular porch?

Answer: The accompanying illustration at Fig. 1 shows the method that we have used in our own work for a number of years, and is probably as good as any other. The central part of the illustration shows the frame work of the floor joists with a portion of the flooring in position.

There should be supports at C, B and D. From C to D is one-quarter of a circle, and this divided in the center, as at B, then the straight lines C-B and B-D are equal to the sides of an octagon with a circumscribed radius of seven feet and eight inches, which is the width of the framework of the porch and the length of the sides may be found by multiplying the radius by the decimal 9.18, which equals five feet ten and three-eighths



(CONTINUE ALL AROUND)
COLONIAL COLUMN.
CENTER LINE
1½" FALL
8' 0"
7' 8"
C
A
FLOORING
2" SEGMEN
e
B
e
2" SEGMENT
D
SECTION OF SOFFIT
FOR STRAIGHT COLUMN.
2×4
C' CIRCULAR SOFFIT. D

FIG. 1.

inches, and is the length to cut the side pieces, and is also the length of the chord of the segment to form the circle to receive the base.

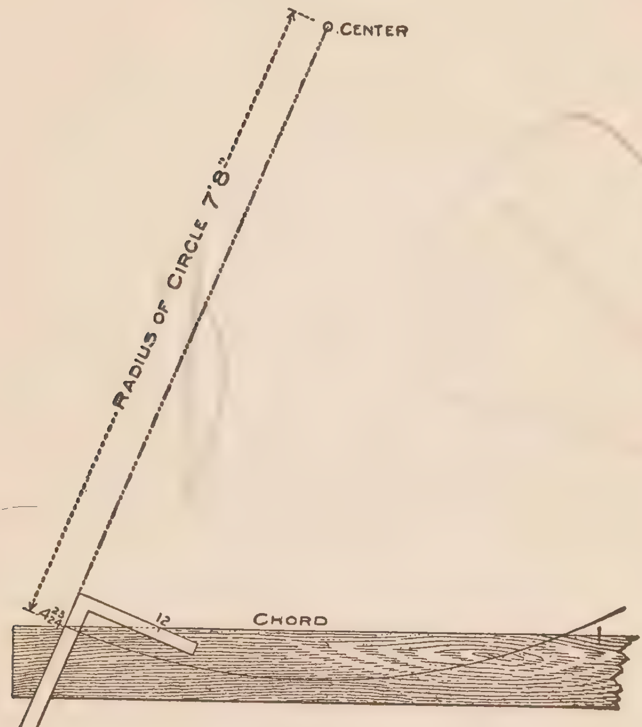


FIG. 2.

In the absence of the above decimal or in case a person is not apt in figures, these parts may be found as shown in Fig. 2. By placing the square on a board, from which the segment is to be cut,

with the figures that give the octagon cuts and lay off the radius in line with the blade, as shown, describe the arc, and it is ready to cut. The figures shown on the square will give all of the cuts required in the frame work about the octagon, as the blade will give all of the cuts at B, also at the other end of the side pieces at C and D. The tongue will give the cut at e and e. The other cuts are the square or on the 45-degree angle. Thus, from this it will be seen that all of the pieces can be successfully framed without first building a part of the framework and scribing the other pieces to it as is the general custom.

There should be four of the segment pieces gotton out, setting one flush with the top edge and one at the lower edge of the joists. The upper ones should be of one and three-fourths inch stuff, same as the joists, while seven-eighths will be sufficient for the lower member. Set blocks between these segments, nailing them well to the joists, also set a few blocks flush with the face of the segments, which makes an excellent form to secure the base.

The ceiling joists are usually put on the narrow way of the porch with an angle piece same as at A-B, on which to form the miter joint of the ceiling.

To form the soffit we use seven-eighths by six or eight-inch sized boards and spring them to their proper place just the same as building a circular girder. The first board should be sprung to a form and the next board well nailed to this

one, and so on till the soffit is to the required thickness or strength, as it is not always necessary to build to the full width desired as it can easily be furred out to the required width. The soffit should be continuous; that is, for the straight part as well as for the circle. Long boards should be used so as to lap well around the circular part, being careful not to break joints on the circular part or at C or D.

A soffit if properly built in this way will not necessarily need a column set at B, as it will be self-supporting. If straight columns are used the outer face of the framework should be flush with the framework below, but if tapered or colonial columns are to be used, then the center of the soffit should rest over the center of the column, as shown in the upper part of the illustration of Fig. 1.

In case a deep frieze is wanted, it may be had by building on top of the soffit girder with blocks, and putting a formed plate on these. For all circular mouldings, it is better to have them solid, and they will then always stay in place, as there will be no kerf joints to open up after the work is completed.

End Cut of Hip to Rest on Adjoining Roof.

Question: Will you please give a rule for cutting the bevels with aid of the steel square, on the bottom end of a hip rafter with "square back" when the same sets on the sheathing boards at comb, as in case of building an addition to an old house, as shown in sketch?

Answer: Fig. 1 is a reproduction of the sketch. The pitch of the two roofs is the same but is not necessarily so, as it is simply one roof joining another and may be of different pitches. If the new hip was to rest on a level plane, as in case of

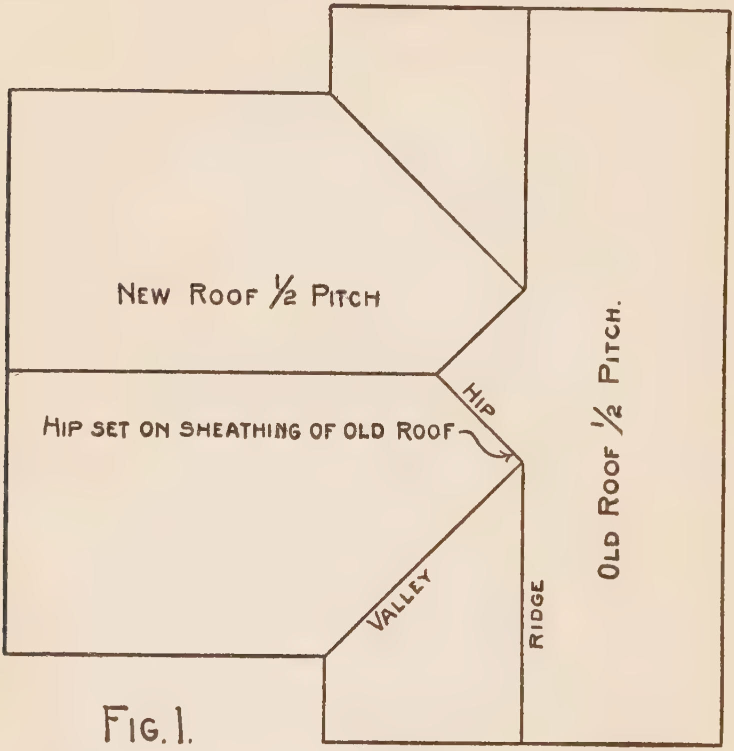


FIG. 1.

a plate, then the seat cut would be 17 and 12, as shown by the broken lines of the square in Fig. 2, But since the seat cut must rest on the sheathing boards of an adjoining roof, we simply apply the square with the figures that give the seat cut for

the corresponding hip for the latter to the seat cut line of the new hip, as shown in the illustration. However, this only gives the angle across the face or side of the hip and another angle across the "square back" of the hip is

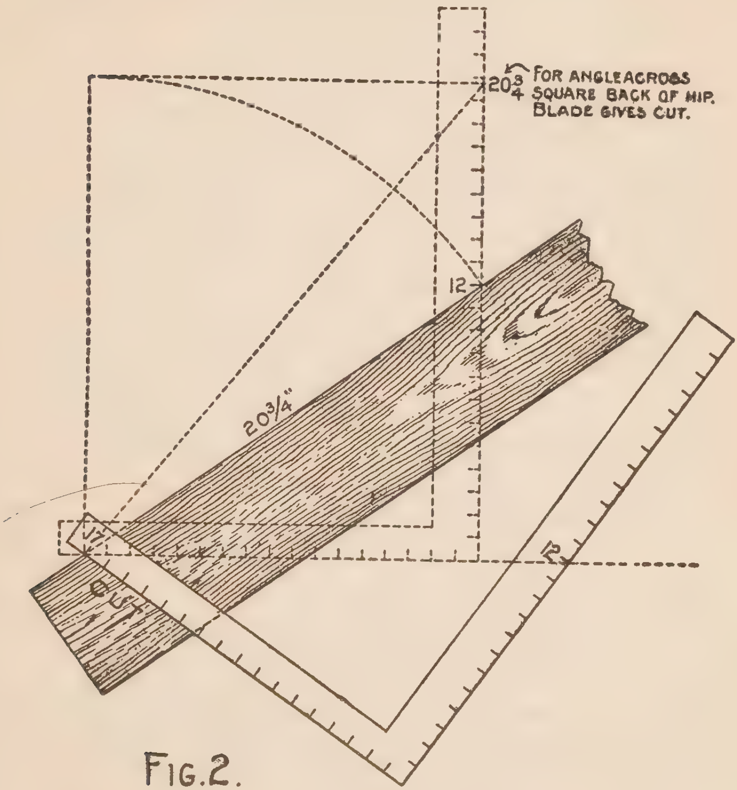


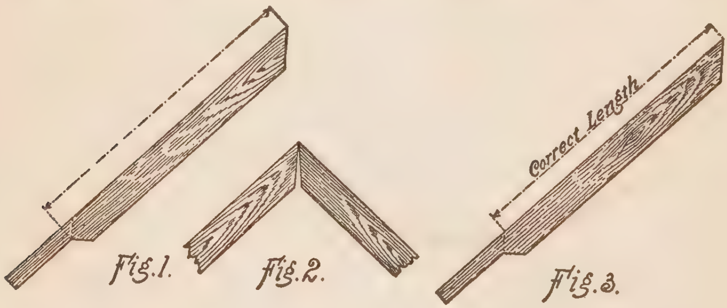
FIG. 2.

necessary to give solid bearing on the roof. This, however, is the same angle as that used at the top end to fit against the ridge board, and in this case is 17 on the tongue and $20\frac{3}{4}$ on the blade.

The blade giving the angle for cut. The dotted lines in connection with the upper square show why these figures are taken. From these illustrations it will be seen that the cut in question is the same as the tail end cut of the hip or valley.

Cutting Rafters.

I would like to add a small item which may set right some of the younger members of the craft and a few of the older heads who never paid any attention to it; in fact, I saw a contractor cut the rafters on a three thousand dollar house



in the same faulty way. It is in the manner of adding the projection for cornice. Fig. 1 is the wrong way and makes the rafters too short, causing the ridge joint to open, as shown in Fig. 2. The right way is shown in Fig. 3.

How to Find Length of Hip Rafters.

Question: Please give me the best way to get the length of hip rafter, cut on any degree.

Answer: Take its run for one foot, which is always 17 on the tongue of the square, and the

rise given the common rafter on the blade. The length from these figures measured across the angle of the steel square will be the length per foot run of the common rafter. These figures on the square also give the seat and plumb cuts of the hip. To get the side cut of the hip take 17 on the tongue and the length of the hip for a one foot run, as described above, on the blade and the blade will give the cut.

Seat and Plumb Cut of Hood Rafters.

Question: What is the rule for cutting hood rafters for a barn if the lower cut is 20 inches and the upper cut is 14 inches? What will be the bevel cut on the upper end of the hood rafter, the pitch of the barn to be 9 inches to 12 inches?

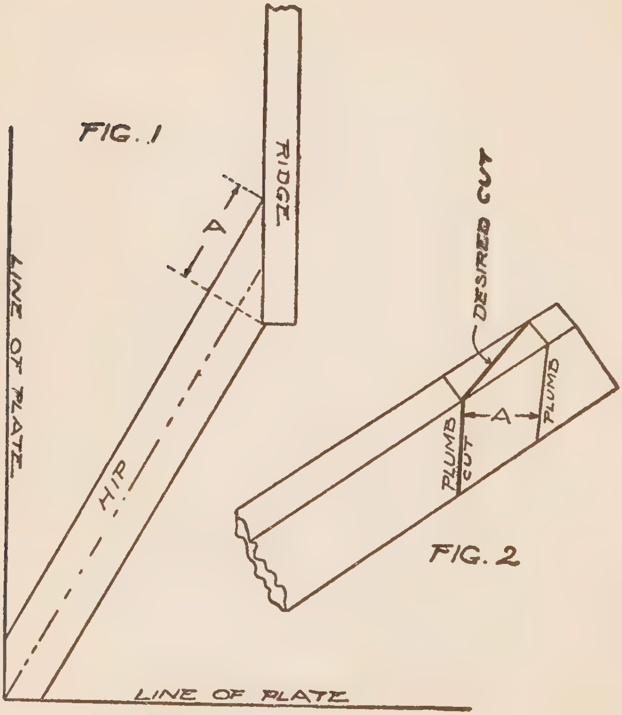
Answer: The seat and plumb cut of hood rafters is identical with that of the common rafter. In other words, if the cuts of the common rafter are 20 and 14, as stated, then the same would give like cuts for the hood rafters, but the pitch would be $8\frac{3}{8}$ to 12 instead of 9 to 12, as stated. Consequently, $8\frac{3}{8}$ and 12 would give the same result as 20 to 14.

Side Cut of the Hip.

Question: Will you give me the rule to get the side cut of the hip?

Answer: When the seat of the hip or valley rests at an angle of 45 degrees with that of the common rafter the rule is this: Take the length of the seat or run on the tongue and the length

of the hip on the blade and the latter will give the cut; or taking the scale of one foot it is 17 on the tongue and the length of the hip for a one foot of the gable on the blade: the blade will give the



cut across the top of the unbacked rafter. The answer to the question asked would be 17 on the tongue and $20\frac{3}{4}$ on the blade — blade gives cut. When the seat of the hip does not rest at an angle

of 45 degrees it can be had as shown in the diagram. Explanation of diagram: Side cut of hip, when the seat of the hip does not rest at an angle of 45 degrees. Fig. 1 shows the position of the hip. Square across the back as at A and lay off this same amount from the plumb cut as at A in Fig. 2, and the diagram line across the back will be the proper angle.

How to Cut a Hip Rafter.

Question: I wish you would tell me how to cut a hip rafter, one for a house with a deck. I mean like this: The height from ceiling joist and the size of the deck will give the length of the hip rafter.

Answer: Deduct the width of the deck from the width of the building and proceed as for the ordinary hip. In other words, if your house is twenty feet wide, and has a deck six feet wide, which, taken from twenty feet, leaves fourteen, and half of fourteen equals the run of the common rafter. Now, if your roof has an eight-inch rise to the foot, seventeen and eight will give the seat and plumb cuts. For the side cut take seventeen on the tongue and the length from seventeen diagonally across to eight (which is eighteen and three-quarters) taken on the blade and the latter will give the cut.

A Square Pitched Roof.

Question: Will you give me the correct figures of a square pitched roof for a building twenty-

two by twenty-eight feet long, and what rise to the foot? Some of our carpenters have different ideas regarding square pitch.

Answer: Pitches are reckoned by the proportion given the span of the common rafters, as one-fourth, one-third, one-half, etc., meaning that the roof has a rise of that proportion to that of the span. Referring to the question of square pitch many carpenters apply this term to the half pitch, because the angles of the rafters rest at ninety degrees with each other and therefore make a square angle at the peak, but this is not a proper term to use in designating this pitch. The figures to use on the steel square are as follows: Twelve and twelve give the seat and plumb cuts of the common rafter, and seventeen and twelve that for the hip or valley. These figures also give the side cut of the jack, the seventeen side giving the cut while the twelve side will give the cut across the face of the roof boards to fit into the valley or over the hip. For the side cut of the hip, take seventeen, and nineteen and seven-twelfths, the latter will give the cut across the top of the unbacked hip, or if it has been previously backed, use the same figures as for the side cut of the jack. The lengths for a building twenty-two feet wide would be fifteen feet and six and two-thirds inches for the common rafter, and nineteen feet and seven-twelfths inches for the hip, which would be taken on the top backing line. If the jacks are set on two-foot centers the common difference will be prac-

tically two feet ten inches. Or if they are set on one foot four-inch centers the common difference will be one-third less.

Miter Cut on a Moulding.

Question: In making a miter cut on a moulding, for instance to form a right angle, would you designate the cut as a 45 or 90-degree one?

Answer: A miter is reckoned by the angle in degrees that it stands between the horizontal and perpendicular. Therefore an angle of 90 degrees

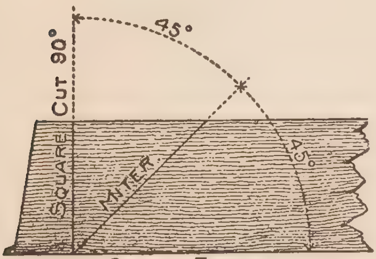


FIG. 1.

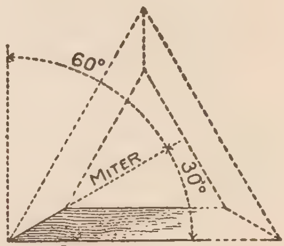
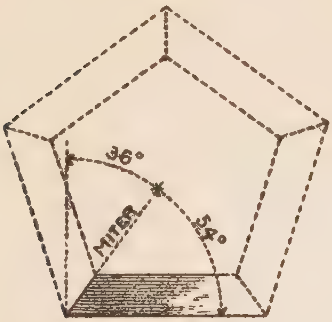


FIG. 2.

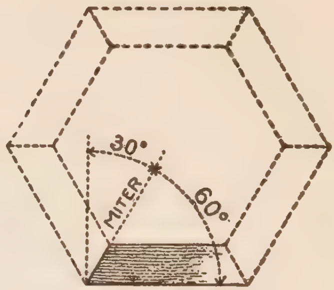
is not properly a miter. Some claim that it is a butt miter, but we differ with them there. It is simply a square cut and may be properly called a "butt joint," but never a "miter joint." To find the angle on the steel square to obtain the miter we divide 180 by the number of sides in the frame. Thus, the quotient for the right-angle corner or four sided frame is 45, and represents the angle of the miter as shown in Fig. 1. In this case it is at the half-way point between the horizontal and the perpendicular. Therefore the

degree of the miter and its complement in this case are equal. In Figs. 2, 3 and 4 are shown the angle of the miter for three, five and six-sided



OUTER EDGE

FIG. 3.



OUTER EDGE.

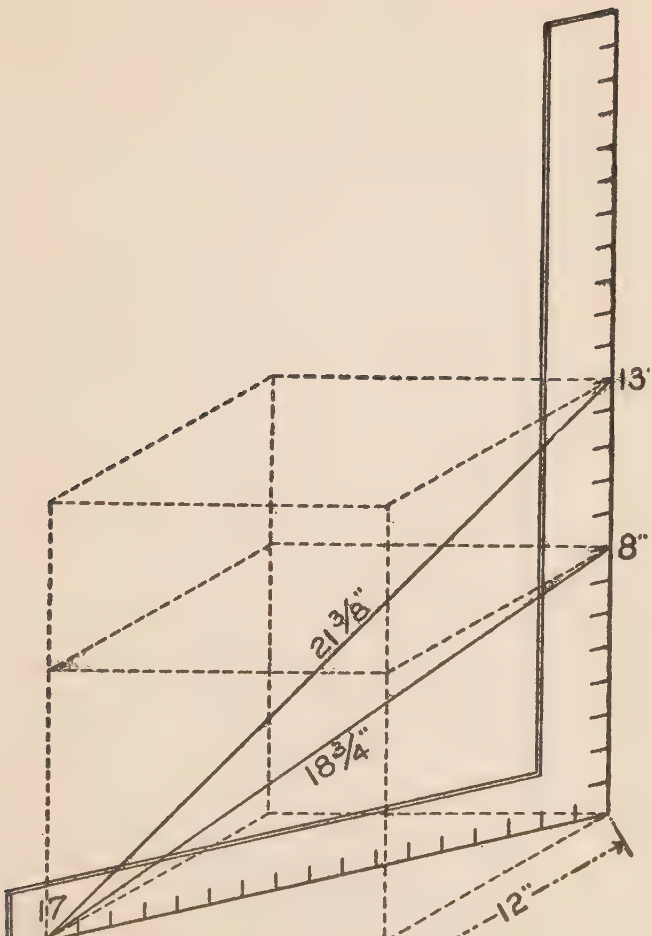
FIG. 4.

frames. In each case it is the complement angle that must be taken on the steel square to obtain the miter.

Length and Cuts of Hip Rafters.

Question: I wish you would explain if the figures 17 and the rise of the roof will give the length and cuts of all hip rafters where all parts of the roof are same pitch, or will it only cut those that are less than square pitch?

Answer: All of the cuts and bevels about a roof are contained in some parts of an imaginary cube. In the accompanying illustration we show a cube twelve inches square at the base. From this, it will be seen that the diagonal of the base is shown as being 17 inches on the tongue of the square in connection with the same. However,


13"
8"
21 3/8"
18 3/4"
17
12"
12"

the real length is only 16.97 + inches, which is so near 17 that it is near enough as far as the cuts are concerned. This applies to the seat cut of the hip rafter so long as the adjoining pitches of the roof are the same, regardless of the pitch given the roof. In the illustration we show two pitches, that for the 1-3 pitch or 8 inches rise to the foot, and 13-24 pitch or 13 inches rise to the foot. The solid lines from 17 on the tongue to these figures on the blade represent the position of the hip, and the figures on the same represent their corresponding lengths per foot run to that of the common rafter. 17 taken on the tongue and these lengths ($18\frac{3}{4}$ and $21\frac{3}{8}$) taken on the blade will give the side cut of the unbacked hip for the respective pitches, the blade giving the cut.

Explaining Board Measure.

Question: I would be very glad if you would explain the meaning of the figures running parallel with the blade of the square.

Answer: There are squares and squares; in other words there are many squares that contain figures on the body of the blade for various purposes.

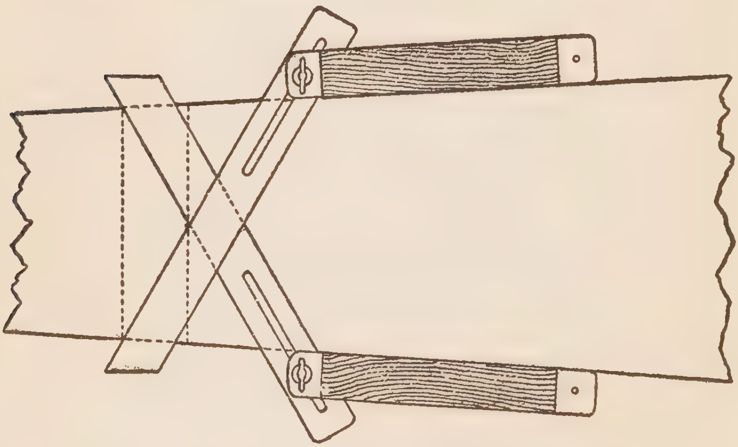
A few years ago we were called on to prepare drawings for the patent office for a square to contain a rafter table on the blade of the square. After the drawings were filed in the patent office the applicant was cited to more than a dozen squares on which he was infringing on the rights of others. This led to an investigation of the

claims set forth by the different patentees, some of them dating back for a number of years. Most of these were found to contain a lot of figures more or less confusing and otherwise impracticable. If these parties had known the true use of the right angle formed by the blade and tongue of the square and the simple scale thereon, they would not have applied for letters patent for their invention and would have been both wiser and wealthier.

Besides the squares referred to, many others have been patented, but very few of them have ever been placed on the market. However, some of them were, and it may be one of these squares that our friend possesses, but we presume the one he has contains the board measure which has been stamped on most all of the squares for these many years. The fact that it has not yet become generally known by the men for whom it was intended shows it to be of but little importance. In fact, we can not now, after more than twenty years' experience among builders, recall a single instance where we saw this board measure referred to to find the contents of a board. Yet it is simple and easy to learn and is as follows: Always look under 12 on the blade for the length of the board and move to a point under the desired width and the figures recorded there represent the contents of the board in feet and inches in lineal board measure. Thus, a board nine feet long and nine inches wide contains six feet and nine inches or six and three-quarters feet.

To Square a Tapering Timber.

Thinking that this design would be of value to many readers we submit same, though it may have been used by carpenters for many years. It relates to the squaring the end of a tapering piece of board or timber, as shown, using the common T bevel. Setting the same so that the blade will reach diagonally across face and mark along the edge of the blade. Note the



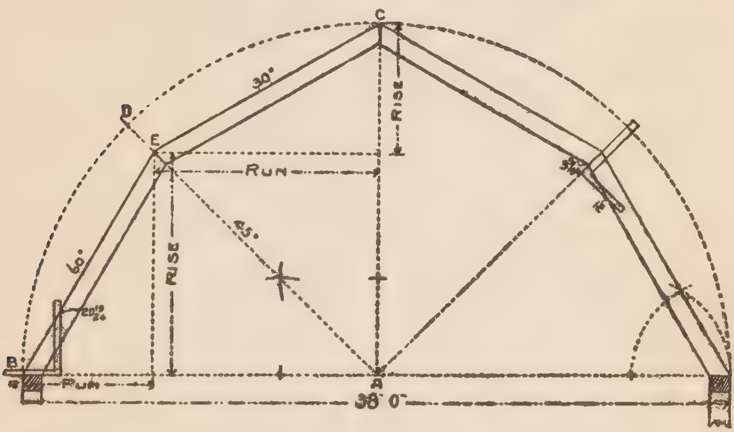
center of the line and reverse the bevel to the other side and set to same. Set bevel blade to these centers and the timber can be squared around on all four sides as easily as if it was a square timber.

Framing a Gambrel Roof.

Question: Would like to know in what proportion to frame a gambrel roof building 38 feet

in width and be self-supporting. How high would you make the knuckle joint to be in proportion with the width of the building?

Answer: We show in the accompanying illustration a gambrel roof. In this the knuckle is placed at the half-way point between the plate and the comb, thus making both sets of the rafters the same length and cuts. A roof of this



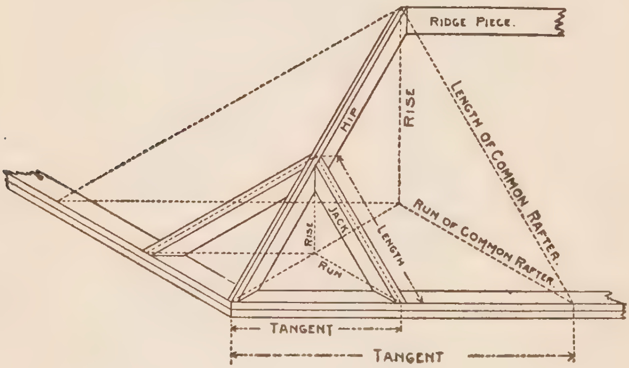
proportion can very easily be laid out with the compass alone, as shown by the diagram. A, B represents the total run; A, C the total rise; and are the same as in the half-pitched roof. 12 and 20 19-24 will give the seat and plumb cuts, while 12 and 3 5-24 will give the cut at the knuckle.

Side Cut of the Jack.

Question: How would you obtain the side cut of the jack with the aid of the steel square?

Answer: The question may seem very simple to the majority of the readers, and it is as far as

the square-cornered building is concerned, but very few understand the true principle involved. We dare say most every one would say without hesitation, "Take its run and length on the members of the steel square and cut on length," or they may say take the run and length of the common rafter which gives the same result and gives it correctly, provided the sides of the roof are of the same pitch and the corner is at right angles, but



as a matter of fact the run has nothing whatever to do with this or any other shaped corner. What then? It is the tangent.

In the right-angled corner with an even pitched roof, the seat of the hip or valley rests at an angle of 45 degrees from the plates, and being at the half-way place the run is equal the tangent and for that reason the run has been given the credit which rightfully belongs to the tangents. Practically all of the books on the subject of

traming with the aid of the steel square that have come under our notice make this fatal error and fhose that do not, fail to give the cause and effect. We say fatal because the would-be learner is thrown off the track and his further progress beyond the ordinary hip roof with such teachings is effectually blocked.

The general rule is, take the length from the corner of the plate to the seat of the jack (which is the same as the tangent) to scale on one member of the steel square and the length of the jack on the other. Cut on the length. The illustration shows the parts to take on the square. This rule applies to any kind of a corner or pitch. If one side is steeper than the other, then the respective sides must be treated in like manner, but separately.

Length of Hip Rafter.

Question: Will you explain how to get the length of a hip rafter for a half-pitch roof for a building 17 feet 7 inches wide, making 8 feet 9½ inches in the run? I take 17 and 12 on the square eight times for the 8 feet in the run. What I want to know is how to get the 9½ inches. Also how to get a valley rafter for a gable of half-pitch to fit over another of three-eighths pitch.

Answer: The reason 17 is used is because it is the practical length of the diagonal of a one-foot square, and 12 is used because it represents the half-pitch to a one-foot run as shown in Fig. 1. Therefore, these figures taken on the steel square

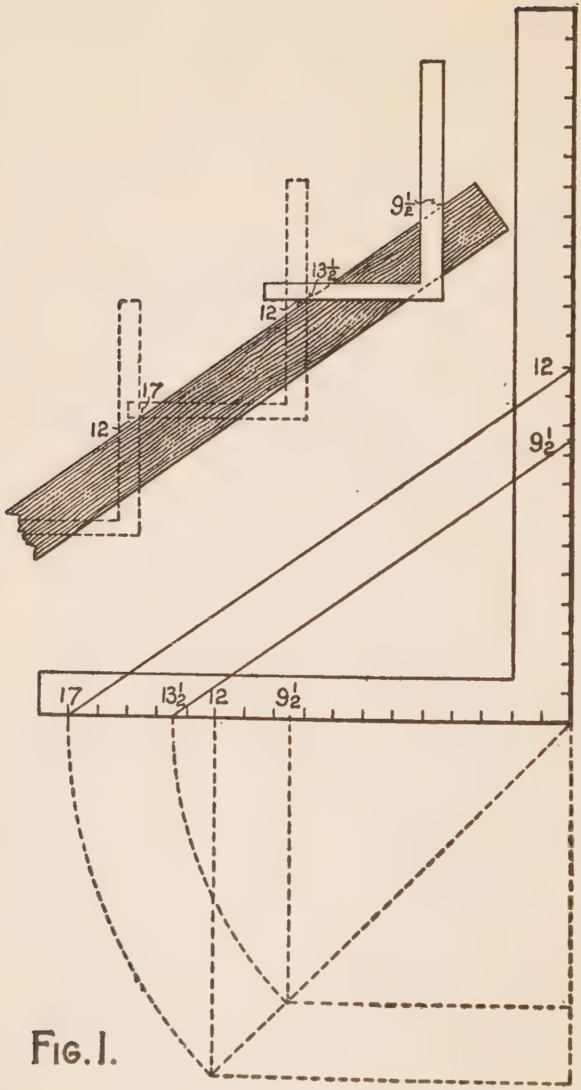


FIG. 1.

eight times will give the length for the 8 feet in the run, and for the 9½ inches proceed in the

same way taking the diagonal of 9½ inches, which is 13½, and a line drawn from 13½ parallel with the one from 17 to 12, and the point of intersection on the blade will be the figures to use for

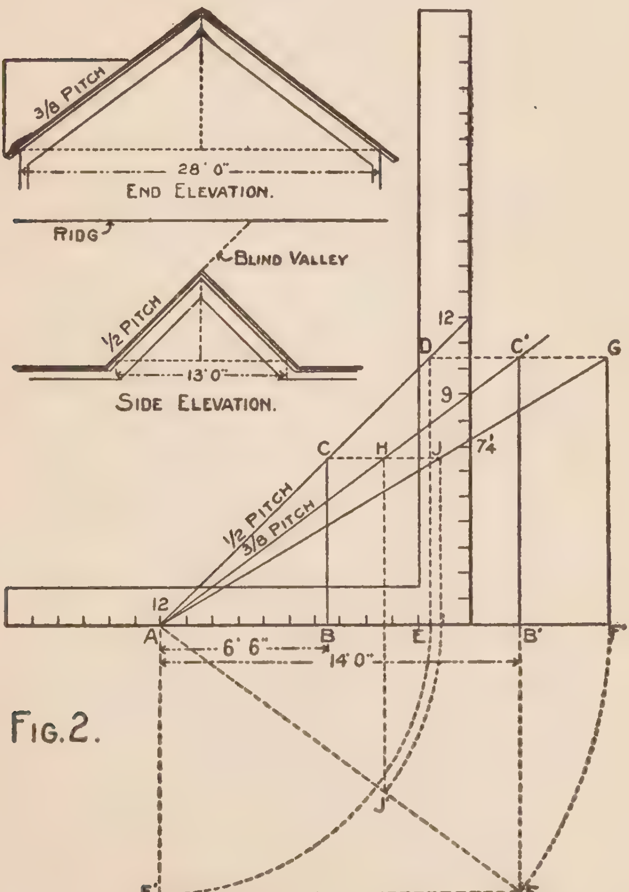


FIG. 2.

the last application of the steel square to obtain the length for the extra 9½ inches in the run. In the case of a half-pitch, the rise being equal to the run, the figures on the blade are the same as those in the run. This should not be allowed to confuse, as it does not occur in any other pitch. To get the length of valley you wish, first lay off

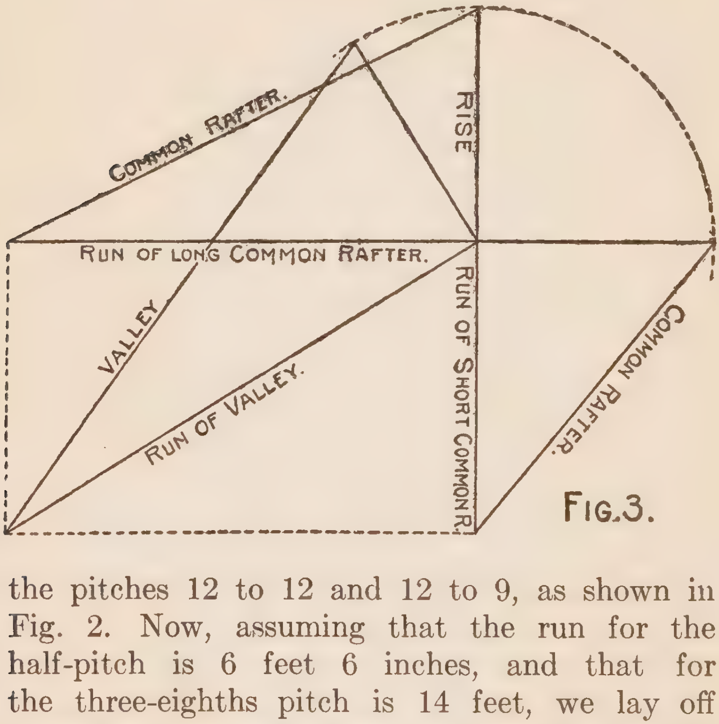


FIG. 3.

the pitches 12 to 12 and 12 to 9, as shown in Fig. 2. Now, assuming that the run for the half-pitch is 6 feet 6 inches, and that for the three-eighths pitch is 14 feet, we lay off these lengths on the run as shown at A B and A B′. Square up from B and B′ to the respective pitches intersecting at C and C′. Then A C will be the length per one-inch scale for the common rafter for the half-pitch,

and A C′ will be the same for the three-eighths pitch. Now for the length of the valley, square over from C′ to D and drop to E on the run, and this transferred to A E′ represents the end and A B′, the side of a plan whose diagonal A F will represent the run for the long valley to catch the ridge of the main gable, and this transferred to F′ and erect the rise F′ G, and draw the line A G which will be the length of the long valley, and by squaring over from B C intersecting A G at J. Thus A J will be the length for the short valley and its run will be A J. The point at H is at the intersection of the ridge of the half-pitch with the main roof. J G represents that part of the long valley commonly called blind valley. I trust the elevations in connection with this illustration will make the subject clear. When the roofs of different pitches are of the same height it is quite an easy matter to arrive at the length of the valley as their runs form the sides of the plan as shown in Fig. 3, which needs no further explanation.

How to Find the Length of Brace.

Question: Please explain how to get the length and cut of the brace, as shown in accompanying diagram.

Answer: The first illustration is as per sketch. The length is determined from the run and rise, same as for the ordinary brace, but the line of measurement instead of being along the edge of the timber (or a line parallel with it) is on a diag-

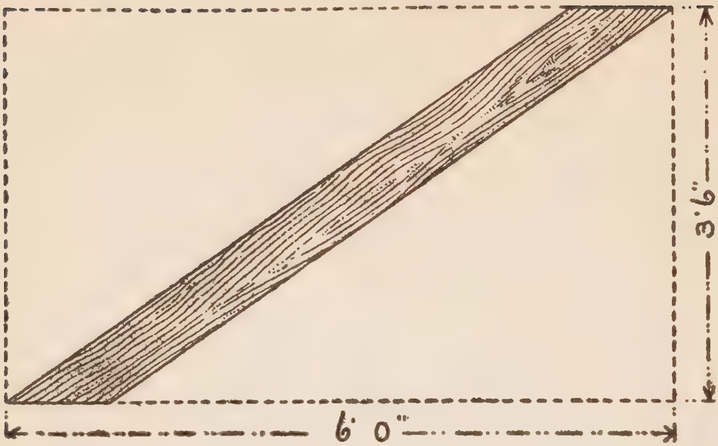


FIG. 1.

onal line across the face of the timber, as shown in Fig. 2. The run and rise taken to a scale on the steel square and applied to this line, will give the cuts as shown. The tongue giving the cut

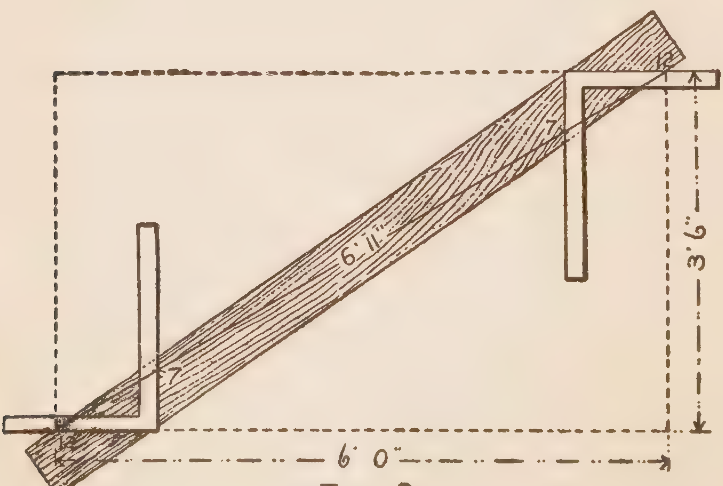


FIG. 2.

for both ends. The figures used on the square can be anything that is in the ratio of those of the run and rise, as 6 and 3½, 12 and 7, 18 and 10½, etc.

Fitting a Hip Jack.

Question: How are you going to fit a hip jack on side cut of 45 degrees when the cut is practically 12 and 17 cut on 17?

Answer: Yes, the side cut of the jack is 12

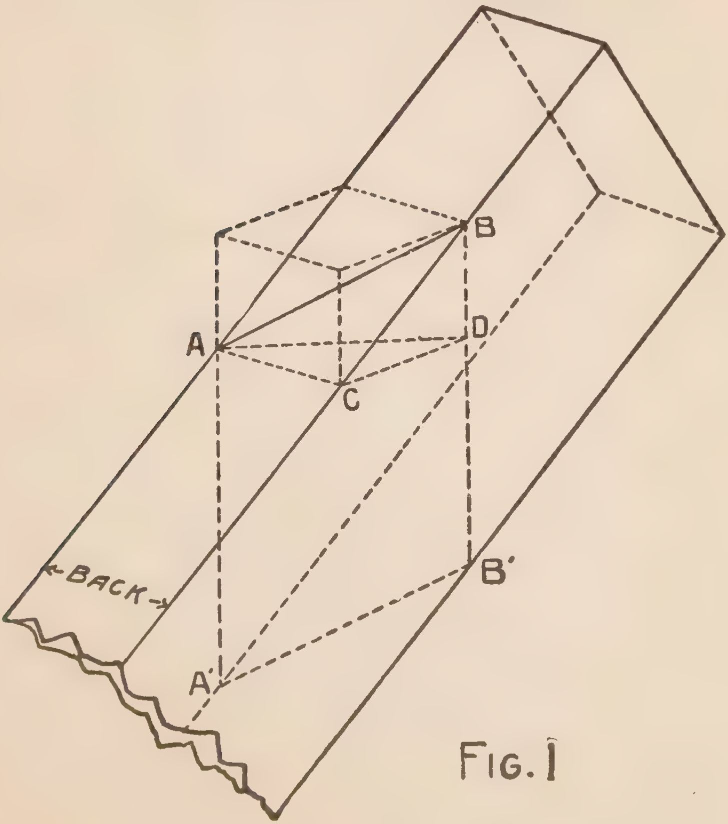


FIG. 1

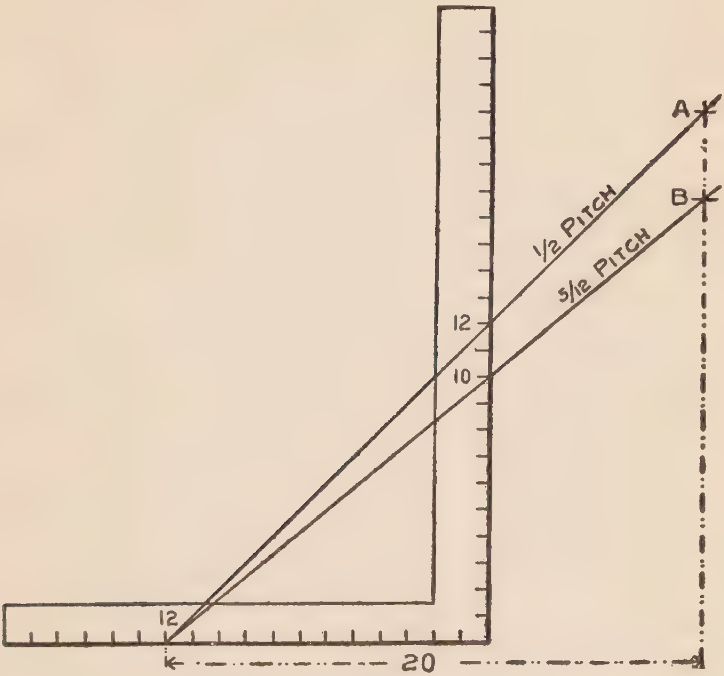
and 17 cut on 17, and is the same as at A-B in Fig. 1. After this cut has been made cut off the peak end of the jack on a line parallel with the seat cut as C-D, and it will be found that the side cut is at an angle of 45 degrees or A-D with the sides of the rafter as at C-D, though it took 12 and 17 to get it on the back of the rafter. What is true of this is true of any other pitch, provided the building is square-cornered. If it be an octagon roof, then the angle would be at 22½ degrees. If it be for a hexagon roof, the angle would be at 30 degrees with the sides, etc.

Miters for Uneven Pitches.

Question: Will you please explain how to make the cornice member in the angle of unequal pitches? I have found the steeper pitch drops below the other. Will raising the plate make any difference? Would also like the figures to use in mitering the mould, facia and plancier.

Answer: Yes, the plate for the steeper pitch must be raised. With the question the accompanying roof plan is enclosed, with a 5-12 pitch intersecting a ½-inch pitch at the valley. Taking this for an example, we show in the illustrations the two pitches in connection with the steel square. The answer is found in the difference of the rise in the width of the cornice. If the cornice be 20 inches wide, then the plate for the steeper pitch must be as from A to B higher than the plate for the lower pitch. The plancier for a roof of this kind should be level and finished with a

return at the gable, consequently the miters for the several parts would all be at an angle of 45 degrees.

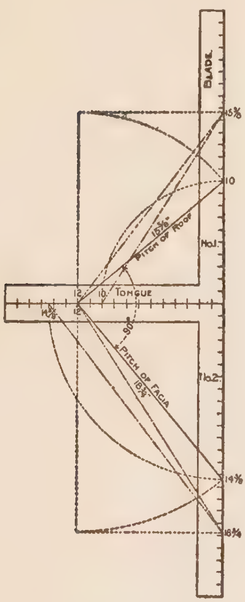


Valley Cuts of Plancier.

Question: Will you please give rule to get the valley cuts of the plancier and facia?

Answer: Just stop and think a minute and it will be seen that the cut of the plancier is identical with that for the sheathing board that rests just above. One fits to the angle of the underside of the valley while the other fits to the angle of the top side. The figures to use on the square

for the angle across the face of the board are the same as those for the side cut of the corresponding jack, but the cuts are reversed on the square, or in other words, say the tongue gives the cut across the face of the board while the blade gives it across the back of the jacks. Now, referring to the accompanying illustration, we will suppose the roof has a rise of 10 inches as shown on square No. 1. The length of the pitch is $15\frac{5}{8}$ and this taken on the blade and 12 on the tongue are the figures to use. The tongue giving the cut across the face of the board.



For the edge or miter, take 10 on the tongue and $15\frac{5}{8}$ on the blade and the tongue will give the cut. Thus, it will be seen that these figures are obtained from the triangle bounded by 12-10 and $15\frac{5}{8}$.

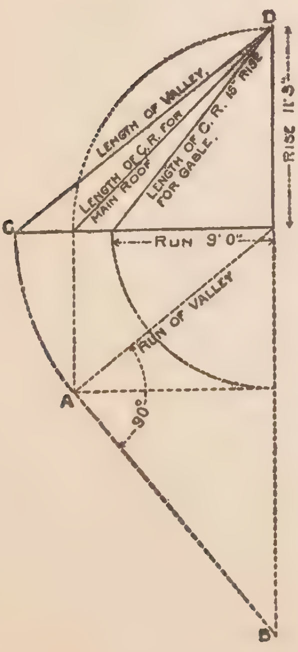
The dotted lines show the movements or the transferring of these parts on the square. The corresponding facia is simply the same as the sheathing boards for an inverted roof resting at right angles from the upper one (provided the ends of the common rafters are cut square), and in the accompanying illustration intersects $14\frac{3}{8}$, as shown on square No. 2. The operation is the

same as that shown on square No. 1. In other words, if $14\frac{3}{8}$ is used for the rise of the roof, then the figures shown on square No. 1 will give the cuts for the corresponding facia. When the rise is 12 inches or one-half pitch, then the figures on both squares are the same and 12 and 17 will give the facia and miter cuts for the roof boards, plancier, facia and the side cut of the jacks.

From this it will be seen that the cuts in question are the same as for hoppers of like pitch.

Exact Length of Cut of Valley.

Question: What is the proper way to get the exact length and cut of a valley in a roof built as follows: The main roof is one-half pitch with a side gable 18 feet wide with 15 inches rise to one-foot run?



Answer: We will answer this question with a diagram supposed to be drawn to a scale of one inch to the foot. First lay off the run of the gable (9 feet) and an indefinite perpendicular line for the rise. Now, since the rise for one foot is 15 inches, for 9 feet it will be $15 \times 9 = 11'3''$ and represents the total rise of

the main roof and gable. Since the main roof is one-half pitch its run will equal the rise as shown by the dotted quarter circle.

Now lay off a parallelogram with side and end equal the run of the common rafters, and a diagonal line through this will equal the run of the valley, and this taken on a continued line of the run of the common rafter as at C, then C-D will equal the length of the valley.

For the side cut, draw a line at right angles from the run of the valley intersecting the plumb line of the rise, as at B. Then A-B taken on the tongue of the square and C-D on the blade will give the cut. The latter giving the cut.

If the two roofs were of the same pitch, the tangent line (A-B) would equal the run of the valley in length. For that reason many suppose it is the run that is used on one arm of the square instead of the tangent for obtaining the cut in question.

Regular and Irregular Rafters.

Here are two questions pertaining to the same subject. The former is regular and the latter irregular. We say irregular, because in the second example the run and projection are of different lengths. Hence the rafter in question is irregular just the same as the intersection of different pitched roofs. In other words, the rafter in question occupies the same position in the roof as the corresponding hip or valley, not a jack rafter, as mentioned in one of the questions.

Therefore, the figures to use on the steel square are just the same as for finding the lengths, plumb and side cuts for the corresponding hip. The former being regular, the side cuts are the

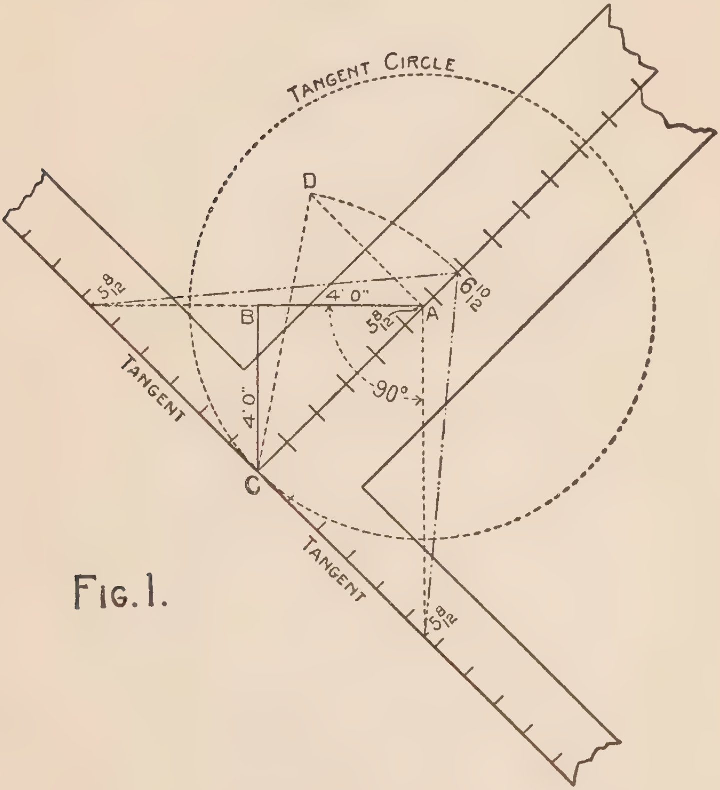


FIG. 1.

same, but in the irregular they are different, yet they are found by the same method, but it requires different figures on the steel square for obtaining the cuts.

Question: Please give the figures to use to

cut a hood rafter for a barn. The hood has an 8-foot span and extends out 4 feet. The rise is 11½ inches. Also give the length of the rafter.

Question: We are building a barn 24 feet wide with 10½-foot rise and wish to cut a pair of

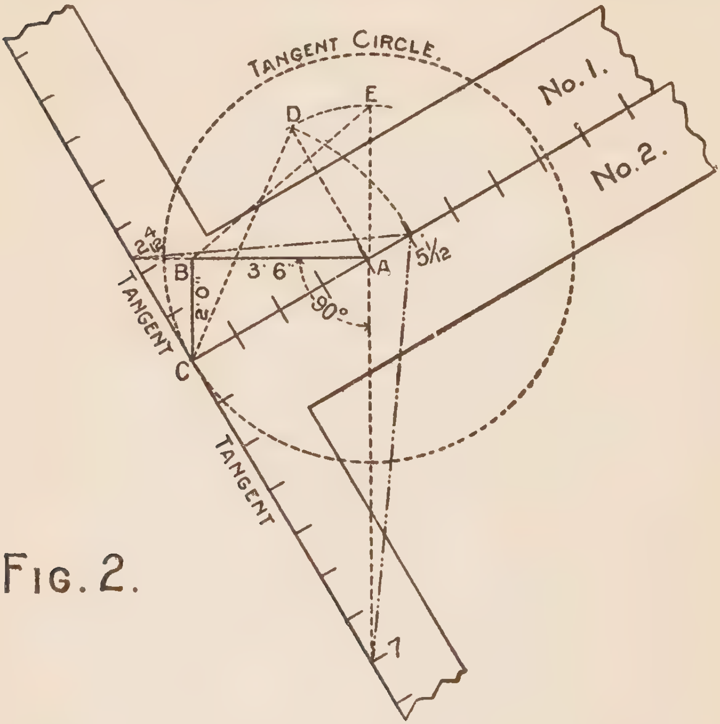


FIG. 2.

jacks to form hood over end of track. The hood to extend 2 feet out from end of barn and to cover 7-foot span at base of jacks. We want to know how to cut them. Please make your answer as simple as possible.

Answer: In Fig. 1 are shown the proportional

figures to use on the steel square for the regular or first question. The triangle bounded by A-B-C represents three measurements, as follows: A-B, run of the common rafter; B-C, projection of hood; C-A, the run of the rafter in question. From the latter, at A, erect the rise given the

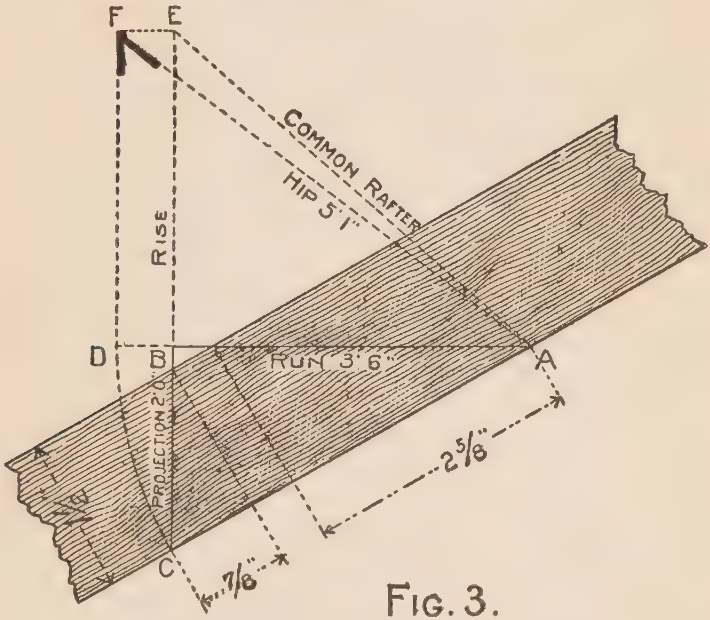


FIG. 3.

common rafter as at A-D and draw line C-D, which will represent the length of the rafter. The diagram can be drawn to any convenient scale. In this, we have used one inch to the foot. To this apply the steel squares as shown. Extend the line A-B till it intersects the tongue, and from A and at right angles from A-B draw a line till it intersects the tongue of the opposite square.

It will be seen that these lines in either case intersect the tongue and blade of the squares at like figures because the seat of the hip rests at an angle of 45 degrees from the common rafter and the ridge or projection, consequently the intersections on the steel squares are of like proportions. The figures on the tongue represent the length of the tangents—not that of the run of the hip, as is generally supposed. Having established the figures to use on the tongue for the

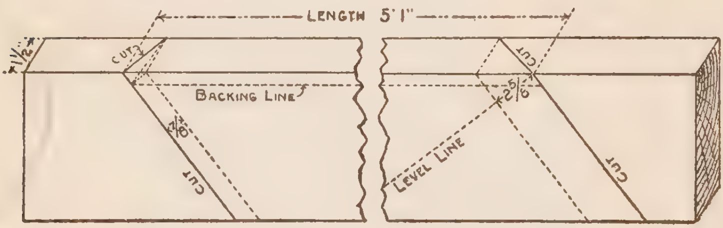


FIG. 4.

top, or more generally side cut of the hip, we will now take the length of the hip C-E on the blade (6 10-12 inches) and the tangent (5 8-12) on the tongue. The blade will give the side cut of the hip at either end across the top of the unbacked hip. The plumb cut, of course, being obtained from the run C-A and rise A-D of the hip. For a rafter of this kind, the backing should all be one way and may be found by taking the length of the hip (6 10-12 inches) on the blade and rise A-D (3 10-12 inches) on the tongue, and the latter will give the proper angle, or it may be found by setting off the full thickness of the seat cut line.

Now, we will take the second example as shown in Fig. 2 and proceed as in the above, but the tangents instead of being equal are found to be of different lengths. Consequently it will require the figures as shown on both squares, as follows:

Square No. 1 will give the cut across the back to fit against the common rafter, while square No. 2 will give the cut across the back at the upper end. The blade giving the cut in both cases.

These cuts may also be had by first backing the rafter and applying the steel square with the figures that give the side cut of the corresponding jack, as follows:

Length of projection C-B on tongue and length of common rafter B-E on the blade. The tongue will give the cut at the top and the blade at the bottom. Of course there are other ways of arriving at the same results, as by geometrical diagrams, but after all it requires the steel square to properly lay off the diagram. Then why not learn to use the square direct to the timber?

In Fig. 3 is shown a diagram of this kind. Taking the above problem for example, lay off the triangle bounded by A-B-C and across this lay off the full thickness of the rafter and square across the back from the intersection of the triangle lines as shown. The $\frac{7}{8}$-inch and $2\frac{5}{8}$-inch are the distances to set square back from the plumb cut lines to obtain the angle across the back. The plumb cut is found by erecting the rise as from

D on extended line B-A equal to B-E. Then F-A will represent the length of the rafter and the cut may be had by applying the steel square with the proportions A-D and D-F, or it may be had by applying a bevel at F, as shown.

In Fig. 4 is shown the lay out on the rafter, which, we trust, needs no further explanation. But, after all, there is nothing better for such work than a thorough knowledge of how to use the common steel square. There are a number of patented instruments now on the market for which are claimed the simplification of framing in general. Some even go so far as to claim superiority over the steel square. At best these instruments are only limited to the more common things in regular work and their scope is necessarily limited.

Constructing a Pentagon.

Question: What figures would you use on the square to form a pentagon? Also what ornamental designs can be formed therewith?

Answer: If we place the steel square on a board with the figures that give the miter for the pentagon, as shown in Fig. 1, and cut out that part covered by the blade and tongue, the two end pieces would form a miter with a right-angled corner, as shown in Fig. 2. If four blocks the shape of that cut from the board be placed together, as shown in Fig. 3, they will form a perfect square frame. This would occur regardless of any miter used on the square as far as this

figure is concerned, but if the figures on the square for any of the polygonal miters are used for cutting these triangular blocks, they will form

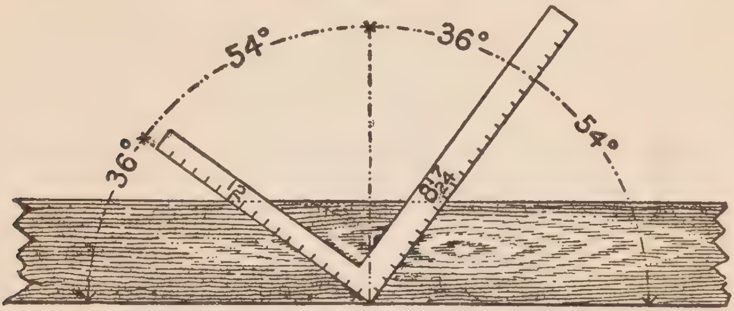


FIG. 1

when placed together, the figure that represents their miter, as shown in Fig. 4. If they are laid with their short and long cuts matching each

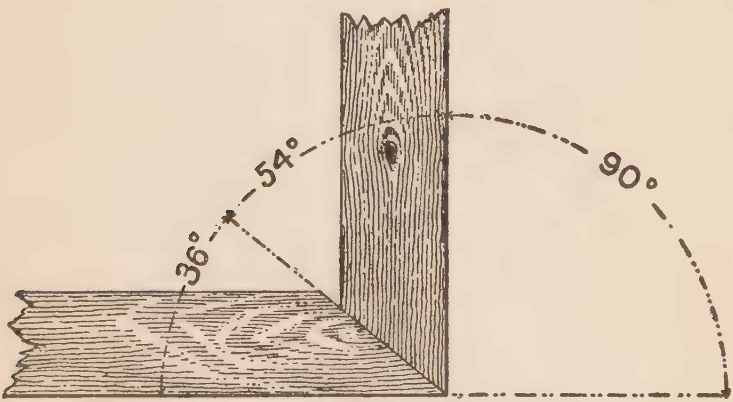


FIG. 2

other, and with points touching, as shown in Fig. 5, they will still tell the part, though cast aside, that they helped to make. They may be arranged

differently but the telltale remains of the part they once occupied.

A very ornamental diagram of the pentagon may be formed with the steel square alone, as shown in Fig. 6, by laying a square on a level

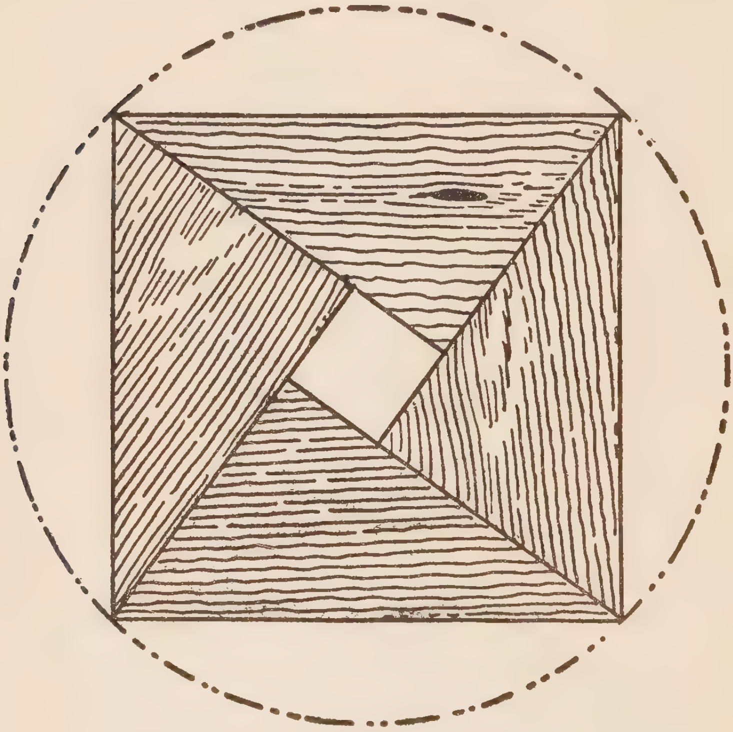


FIG. 3

surface and marking around the same, letting 12 on the tongue remain at the center and 8 17-24 be the intersecting point on the blades. After ten movements of the square has been completed, it will be seen that portion of the blade below 8 17-24

helps to form the sides of a true pentagon, and the intersecting lines from the blades form the five-pointed star. The dotted lines are thrown in to show the accuracy of the work. A very pretty diagram can also be made by reversing the figures

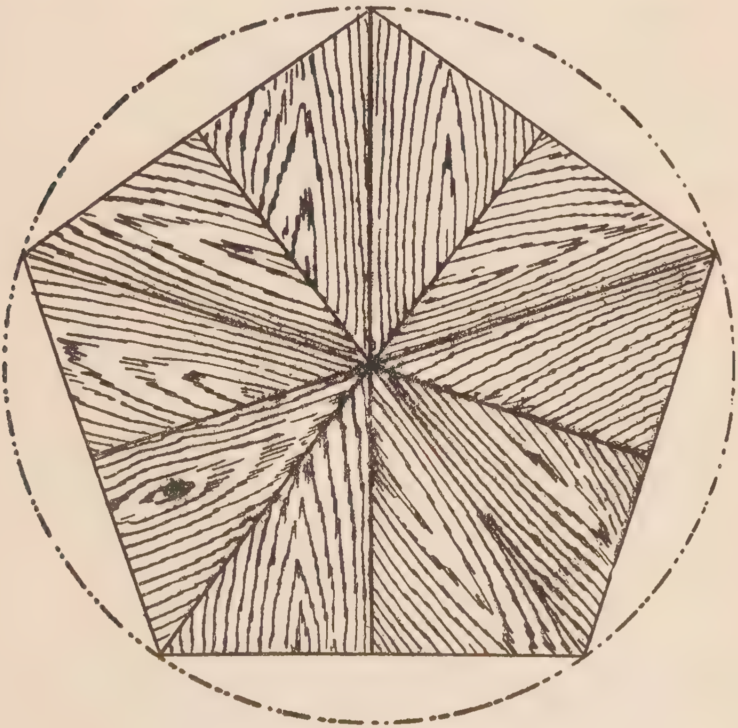


FIG. 4

on the steel square; in other words, let 12 on the blade be the center and 8 17-24 be the intersecting figures on the tongue, as shown in Fig. 7.

For the above illustrations we have taken the pentagon, but the rule is just as applicable to any

of the other polygons and, in fact, some of the others with more corners would make more attractive illustrations. From these it will be seen that the whole make-up of the designs is formed by triangles and their dimensions. Base, altitude

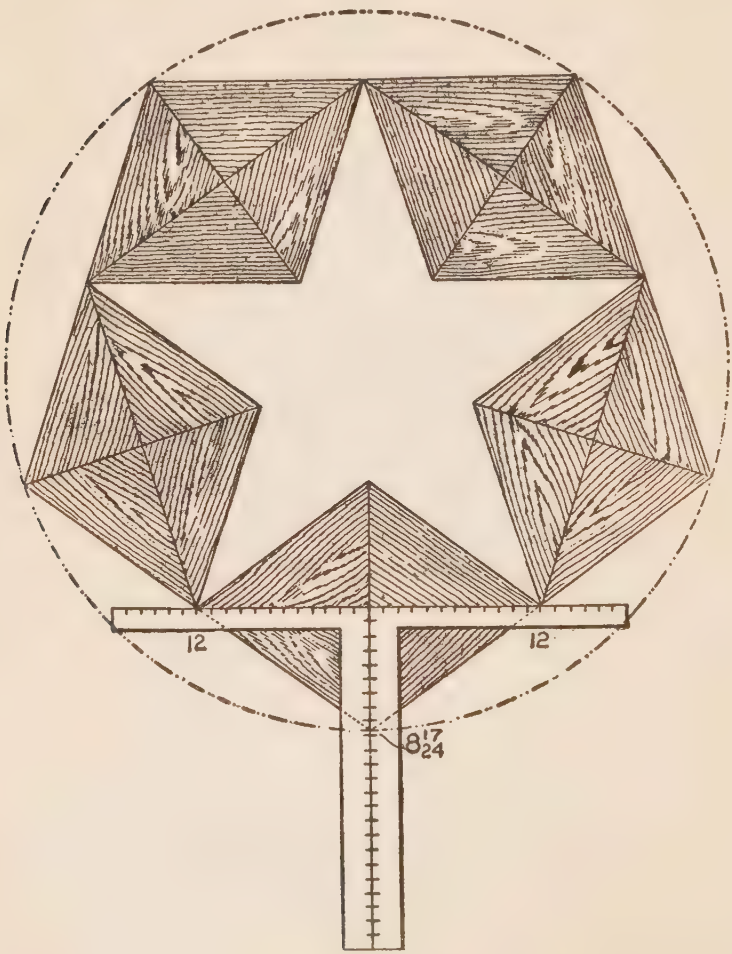


FIG. 5

and hypothenuse are the proportions taken on the steel square to obtain all of the angles, cuts and bevels required in framing roofs, hopper work, etc.

The reader will notice that in all of these illus-

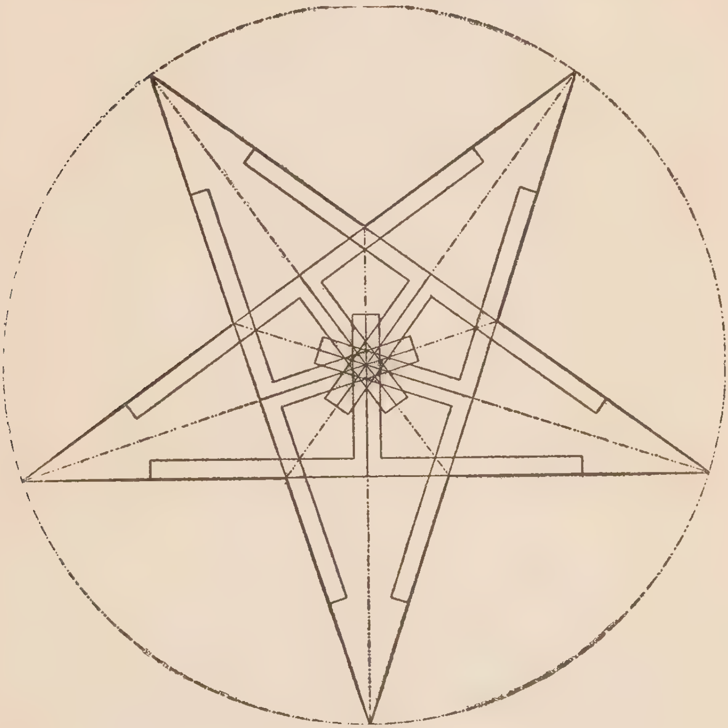


FIG. 6

trations in connection with the pentagon we have used but one set of figures on the square. Of course other figures can be used, but they must be to the proportions given in these illustrations.

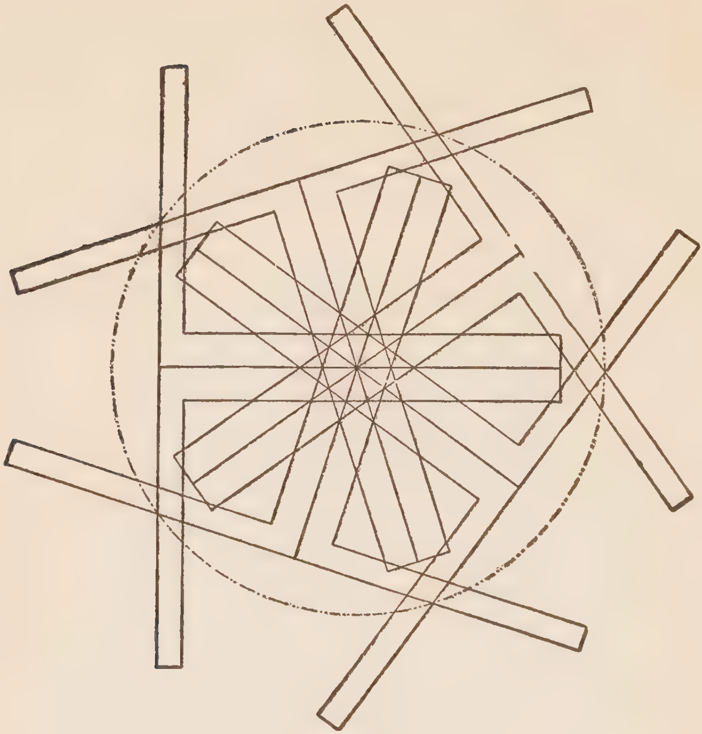


FIG. 7

Method of Constructing Trestles.

Question: Will you kindly show a simple method of constructing trestles?

Answer: The reader may think it is foolish to take up space telling about a saw horse that any boy can make, but my experience has been that if we pay attention to the little, simple things and fully understand them as we pass along, that we gradually observe and learn until the more difficult seem simple as we come in contact with

them. In fact, the mechanic that always pays attention to all little things never has anything too big for him to handle; but the mechanic that never considers small things stops completely when he comes in contact with something just a little difficult, and there he stands until the simple mechanic comes along and shows him what a simple little thing has stopped him.

While it is practically true that any one can

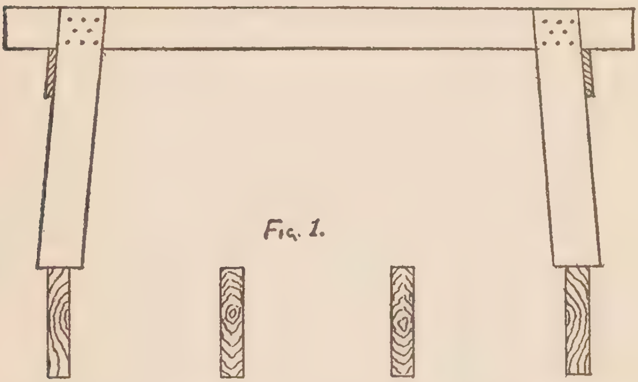


Fig. 1.

make a pair of trestles, yet it is indeed strange how few go at it with any mechanical knowledge of just what they are driving at, or just exactly what kind of a pair of trestles they will have when finished.

Fig. 1. A very good trestle for ordinary use can be made with a 2 by 4 about five feet long, with two legs nailed on each end just four feet from center to center, as hundreds of times it is convenient to put a trestle on uncovered joists.

Fig. 2. If the legs are to be spread at the

bottom to eighteen inches, place the two-foot square on 8 inches on the tongue, and mark there for the bottom cuts of legs, and end of blade for top cut. That gives cuts and length of legs if you

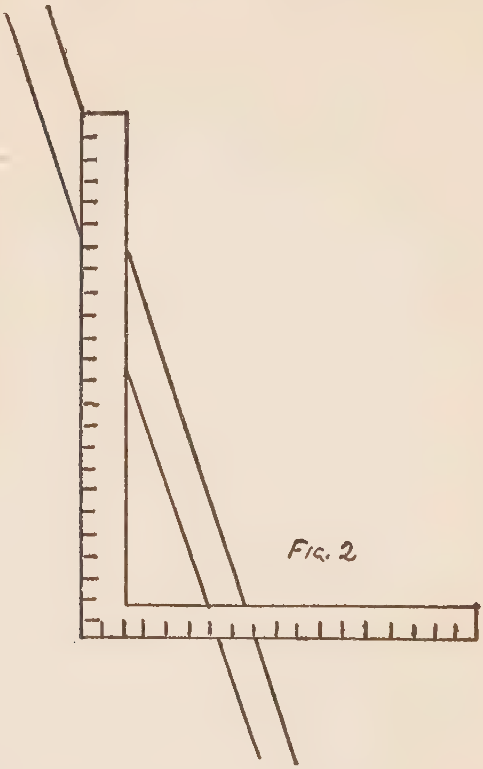


FIG. 2

wish them two feet high, which is a common height.

Fig. 3 shows end of trestle with a 1 by 4 nailed on and complete.

Fig. 4 shows one made with $\frac{7}{8}$ legs, with a 1 by 6 nailed on and a 2 by 6 laid flat, and with a 1 by 4

brace nailed on the bottom. This makes a very handy combination trestle, work bench and stepladder.

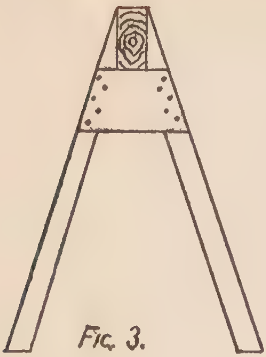


Fig. 3.

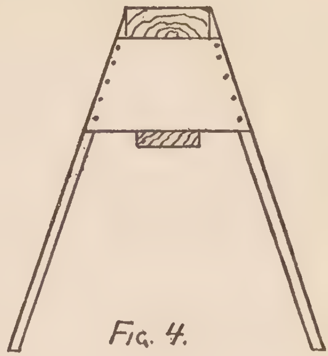


Fig. 4.

Fig. 5 is by far the best trestle I ever used for inside finishing, and is made entirely of $\frac{7}{8}$ pieces—scraps of flooring or anything can be used. The

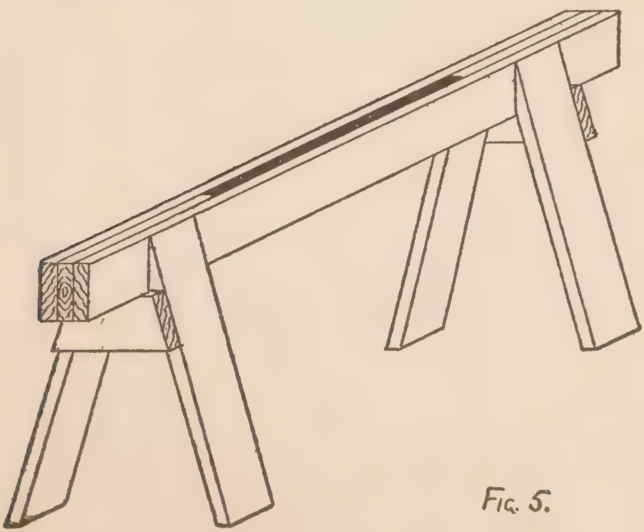


Fig. 5.

slot in the center makes the handiest kind of a vise to hold short pieces of base, etc., while sawing miters, and many other uses, especially handy many times as a tool rack to hold chisels, awls, etc. It makes a very neat, light and convenient all-around trestle for all kinds of light work.

Laying Out an Ordinary Stair.

Question: Kindly show me a simple and accurate manner of figuring treads and risers for floors of any height.

Answer: Stair work on even the simple kinds of stairs is considered by many builders the most difficult part of the work encountered in a building, but it is really not much harder to lay out a stair that it is to fit and hang a door. If one is familiar with the fundamental principles so as to go at it understandingly, a stair for almost any conditions can be quickly designed.

Numerous tables of treads and risers, giving the treads and risers for any floor height or the run of the stairs for a given number of risers, have been published, but all the information necessary can be found by the little rule given below for any particular condition as quickly as by the use of a table.

It has been worked out from theory and found by practical experience that in the easiest stair twice the risers, plus the tread in inches, should equal from 23 to 25 inches. If the ratio is varied much from this the stair becomes harder to climb. No matter how steep or how flat the stair, by

following this ratio it will always be the best stair for the place.

Someone will say, but you don't know what the risers or treads are or how many there are to be. That can be quickly found. We will take, first, the case where the run of the stairs is not fixed. If it is a rear stair we can use a riser of 8 or even 9 inches, and a front stair 6 to 7 inches. Divide the floor height by the riser and we have the number of risers. Now, from our rule we find that the tread equals 24 minus twice the riser, and as there are always one less tread than the number of risers, we have the run of the stairs.

Now, we will take the case where the floor height and run of the stairs are both fixed. Here we take the floor height in inches, double it and add the run in inches. Divide this by 24 and we have the number of treads. Add one to the number of treads and divide the floor height in inches by this number and we have the exact riser height. Divide the run in inches by the number of treads and we have the height of the tread.

The result is the easiest possible stair which will fit the fixed conditions.

To make the explanation clearer we will make a practical application of the rule.

The floor is 12 feet and the run is 16 feet. Twice 12 feet in inches equals 288 inches; 16 feet equals 192 inches, and the sum is 480 inches. Divide this by 24 and we get the number of treads 20 and 21 risers; 12 feet divided by 21 gives us a riser of $6\frac{7}{8}$ inches; 16 feet divided by 20 gives us

a tread of $9\frac{5}{8}$ inches. Twice $6\frac{7}{8}$ inches, plus $9\frac{5}{8}$ inches, equals $23\frac{3}{8}$ inches, which is as near as we can get without using smaller fractions and near enough for all practical purposes.

Of course it is understood that the riser height is from top to top of tread, and the tread length from face to face of the risers. In laying out the strings this must be taken into account. The

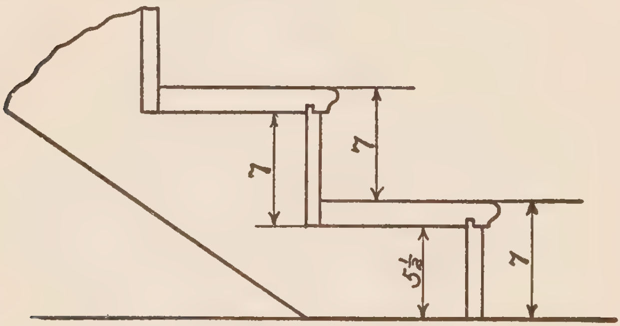


FIG. 1.

string is laid out the same as the rise and tread lengths, with the exception of the first riser, on which allowance must be made for the first tread. By referring to Fig. 1 this will be clearly understood. The foregoing has been with reference to straight run stairs, but a stair with landings or with winders can be treated in the same way. If the stair is one with landings but no winders it is simply a series of straight runs which can be laid out as given above. It must be remembered, however, that if the several runs are in one

continuous stair the risers and treads should be the same throughout, for any change in the treads or risers will be a stumbling block to every one who uses the stairs.

Winders are not desirable if they can be avoided,

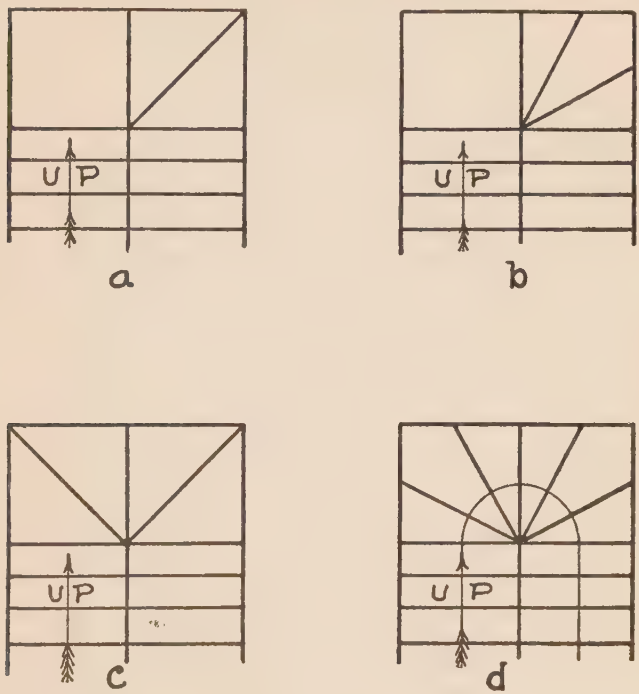


FIG. 2.

but if the space available for the stair has been reduced to a minimum to make room for other things it becomes necessary to make use of them in order to reach the desired height without making the stair too steep. If a case of that kind

comes up, first try it without the winders, and if it makes the stair too steep decide upon the number of more risers necessary to make the stair satisfactory. Where only one or two additional are required they are sometimes laid out in plan on one side only—see Fig. 2, (a) and (b)—making a kind of half-landing or resting place. In (b) one more riser is used. In (c) the same number of risers have been laid out in a symmetrical manner, making a more continuous stair of it. These winders will have the same riser height as the common risers, but of course the tread length which is on the curve, as in (d) Fig. 2, varies with the number of winders. This is not theoretically the correct way of planning winders, but for cheaper stairs it is the method used. When the stairs are elliptical or circular and of stone or iron the winder treads are worked out in the proper ratio to the riser.

Finding Correct Cuts for Hoppers.

Question: Will you give a method of finding the side, miter or butt cuts for hoppers?

Answer: The methods of finding the side, miter or butt cuts for hoppers and like class of splayed work seem almost endless, and all this is so confusing to the young joiner that his progress in this direction is usually slow, especially when he is shown one method for a square angle, another for an acute, and still another for an obtuse angle, when the work is to be mitered at the angles, and, perhaps, a separate method for

each of the angles when the work is to be butt jointed.

It is the purpose of this article to present to the reader ways and means of obtaining the correct cuts for this class of work, showing two simple methods, one for mitered angles and one for butt joint angles, and covering all classes of work, so long as the slant to the sides is uniform, whether it is a square, an acute, or an obtuse-angled corner. The careful student will readily see that this means triangular, square, pentagonal, hexagonal, heptagonal, octagonal, or any other "gonal" kind of splayed work, whether for hopper, spire, column or other purpose.

To make all plain, we will refer the reader to the drawing in which Fig. 1 teaches the whole art. The same reference letters are used in representing the same line in each of the angles for which the cuts are desired, so the directions will answer for any one. Just pick out your own angle, whether it be the square angle shown at (a), or the acute angle shown at (c), or the obtuse angle shown at (b). First, draw a plan of the angle as at A; these lines we will call the base lines. Parallel to these lines, at any convenient distance, the greater this distance the more accurate will the drawing be, draw other lines as shown which will form an angle, as at a, which will correspond to the angle A. Connect A-a and the miter on the plan is found, which would be the proper one to use if the edge of the side was beveled to lie in a plane with the plan, as in Fig. 2,

but if the miter across the square edge is desired, we would proceed as follows: From the base line on either side of the angle draw a line corresponding to the slant of the work, as e-f; from f, with a radius equal to the distance across to the base line, draw an arc intersecting e-f at i; and through i parallel to the base line, draw a line to point of

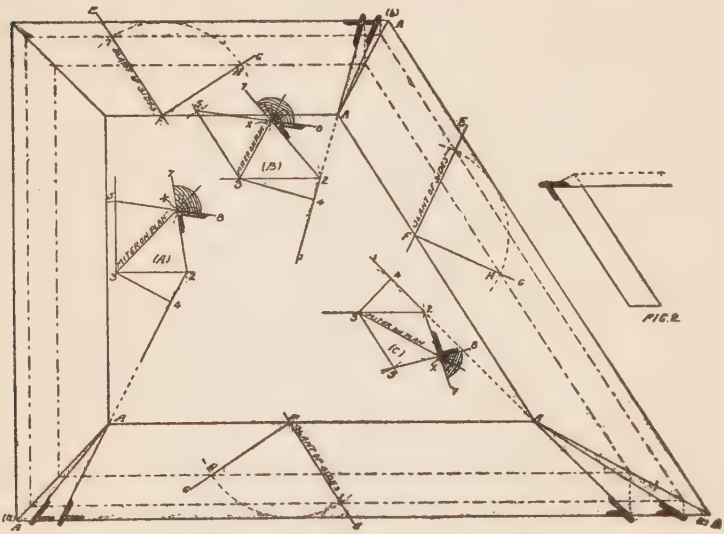


FIG. 1

intersection with miter line, A-a, on plan; square over to the base line and connect to the interior angle a, and the miter is found, as shown by the bevel.

To find the bevel for the cut across the sides, draw from f, previously found, f-g at a right angle to e-f, and intersecting the arc i-h at h. Through h parallel to the base line draw a line to point of intersection with the miter A-a on the plan,

square over to the base line from this point, and connect with the interior angle a, and the angle formed by this line and the base line is correct for the bevel.

Let us now consider the scheme for developing the lines for a butt joint for the square corner, as at (a); or the obtuse corner, at (b); or the acute corner, at (c), shown on the interior of the diagram, in which the same reference figures refer to corresponding lines in the different diagrams, as before. First, we will draw a line 1-2 corresponding to the bevel cut across the sides, which will be the same as found before, the work having the same slant to the sides. From 2 draw 2-3 corresponding to the edge of the board or base line. At a right angle to the line 1-2 from any point draw 3-4, and from 3 draw 3-5, which, with 2-3, will form a plan of the angle for which the bevel is desired. Make 3-5 equal to 2-3, and from 2 and 5, with a radius equal to 4-3, strike arcs intersecting at x, and from 5 and 2, through x, draw 5-8 and 2-7; then the angle formed at 2-x-8 or 5-x-7 will be the angle for the bevel sought, and 7-x-8 will be the correct bevel for a corner strip to fit the angle formed by the sides.

These methods have been in use for years—long, long before I learned to saw to a line—but because of the simplicity and that the principle of either answers so well for all purposes of the problems involved in the case, I have deemed them of value to all workmen, especially the beginner.

Cutting Siding for a Gable.

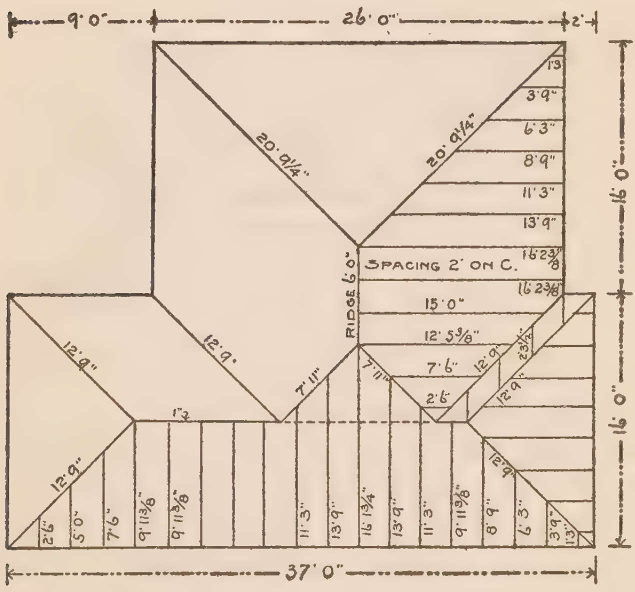
How many of you ever tried cutting the siding for a gable on the ground, instead of on the tresses? The idea is original as far as we know, as we have never seen anyone else use it. It is much easier, quicker, more saving of siding and much more satisfactory every way than to cut it out on the scaffold. As soon as you are well into the gable fit in a piece to run clear across the gable if possible. Now be sure and cut this to fit neatly, as it is your pattern. Now take this to your tresses and with your working gauge lay off what you want to show to the weather. Gauge all your timber for the gable this way. Now lay the piece already cut on the next piece to be cut, with the gauge line at the bottom of the piece to be cut just as it will appear when put up, and mark the length. Now lay your pattern on top of the piece to be cut and mark your angles same as pattern. Don't use your bevel square, for if the siding is not exactly straight your bevels will be wrong. Now proceed in like manner, until all are cut; then all you need to take to the scaffold is your hammer and block-plane, and you will not need your block-plane if you have been careful to cut the angles like the pattern, and you have no nails to set to hold your siding while you mark it.

How to Frame a Roof.

Question: I am sending you a plan of a two-story house. Will you give me a plan of a hip

roof for this building? The cornice will project 1 foot 6 inches from the plate. Give lengths of the hip, valley and common rafter.

Answer: As the pitch desired is not stated, we will assume it is a 9-inch rise to the foot. The accompanying plan gives the length of the

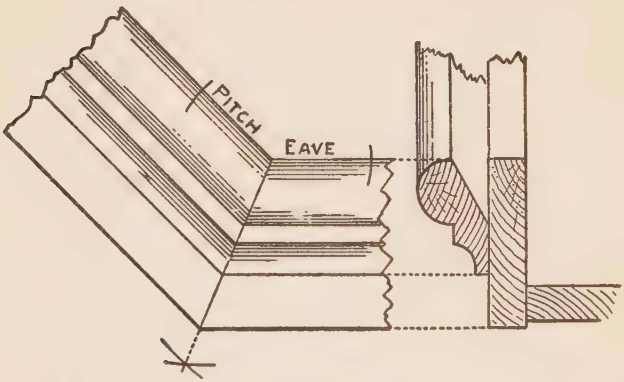


various rafters. Care should be taken to see that the dimensions of the building are correct and the angles perfectly square. The net lengths of the rafters are given so that it is not necessary to make deductions from the ridge piece. The measurement for the jacks is given for the long side.

Intersecting Gable with the Eave.

Question: Please give a rule for cutting and adjusting rafters when gable and eave cornice intersect in order to have the facias come same width.

Answer: Frame the rafters and valley just



the same as for an internal angle. In cases of this kind, the plancier should be level with plumb facia. Then the miter would stand at the half-way point between the pitch and the level line of the eave, as shown in the illustration. The different pieces will number and be of the same width.

Finding Angles, Cuts and Bevels for Polygonal Sided Buildings.

Question: Kindly illustrate a method of obtaining the angles, cuts and bevels for polygonal buildings, on the steel square.

Answer: In Fig. 1 we show how the figures are obtained on the steel square for the side cuts

of the hip, but in this we will only show those most commonly used, namely, the square, hexagon and octagon. The others are omitted to avoid complication of the many lines that would be required in the illustration. Even in this not all of the movements or lines are shown, except for the square; but the reader must bear in mind what

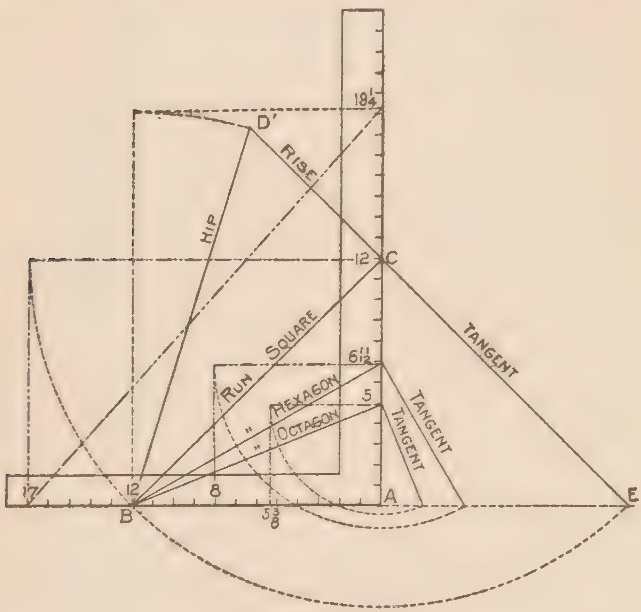


FIG. 1

is said of one polygon is true of all, no matter how many sides they may contain, provided they have sides of equal lengths and the roof lines radiate to the center. In other words, a building may have true polygonal corners, yet the roof may be irregular from the fact that part of the number of sides may be of a different length. When this

is the case, the polygon is irregular and the illustrations given do not apply here, though the figures to use on the steel square are determined from the same standard of proportion, but the hips being of different lengths, the measurements necessarily partake of both, and consequently it requires a different set of figures on the steel square for the different sides. Therefore, the following pertains only to the regular pitched roofs.

In this figure the starting point is at 12 on the tongue, from which lines are shown to the respective tangents on the blade. These lines represent the run of the hip as compared for a one foot run of the common rafter. The figures shown on the blade represent the tangents for the corresponding run of the common rafter. To find the same for the hip, it is only necessary to run from these figures, square out from the run lines, intersecting a continued line of the run of the common rafter, as at E on line B-A, as shown from the square cornered building. The length of these lines represent the tangents, and when transferred to the tongue, as shown by the dotted lines, represent the figures to use on that member for the side cut of the hip, regardless of the pitch given the roof. But not so with those used on the blade, for the plumb cut, because they are regulated by the pitch given the roof. In this we have taken the nine-inch rise to the foot, and as will be seen, is simply a continued line of the tangent as C-D′, then the line B-D′ represents the length of the hip, and this transferred to the blade rep-

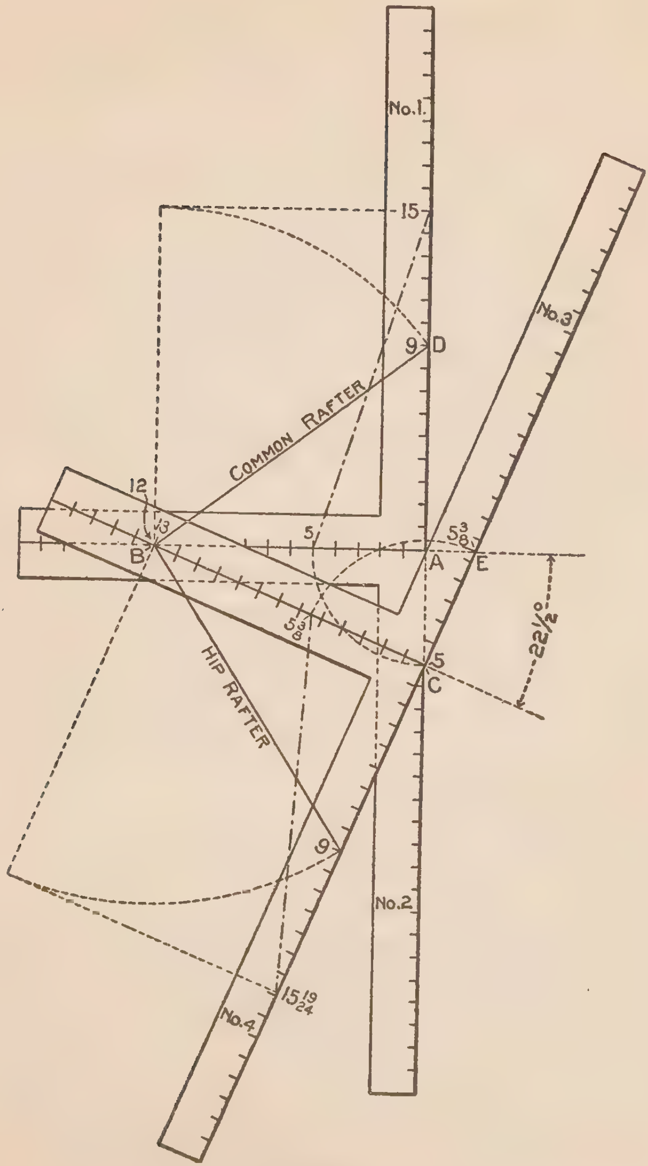

No.1
15
9
D
No.3
COMMON RAFTER
12
13
5
5 3/8
A
E
B
22½°
5 3/8
5
C
HIP RAFTER
9
No.2
15 19/24
No.4

FIG. 2

resents the figures to use on that member. Then 17 on the tongue and $19\frac{1}{4}$ on the blade will give the side cuts across the top of the unbacked hip. The blade giving the cut.

Note.—The length of the tangent for the square-cornered building is equal to 17 inches, which is also the length of the corresponding run, as shown by the dotted circular line. For this reason it is generally supposed that 17 is used on the tongue because it is equal the run. This is very misleading, as it does not apply to any of the other polygons, as will be seen in the case of the hexagon and octagon, which are shown to be 5 and $5\frac{3}{8}$ respectively.

Proceed in like manner to find the figures to use on the blade for the hexagon and octagon.

The octagon being more generally used than any of the other polygons, we will now take it up separately, showing the different figures to use on the steel square; but in this the angles are shown on separate squares, as will be seen in Fig. 2, as follows:

12 and 9 on No. 1 give the seat and plumb cuts of the common rafter. The squares No. 2 and No. 3 are used to form the plan, as bounded by A, B and C. The intersection of the heel No. 3 being at 4.97 on the blade of No. 2, which is as near 5 inches as can be worked to, and is therefore near enough for practical purposes, and with the tongue intersecting 12 on the tongue of No. 1 forms the plan, as above described, and happens to be at 13 on No. 3, and represents the run of

the hip. To this the square No. 4 is applied, and on the blade the rise is taken to correspond with

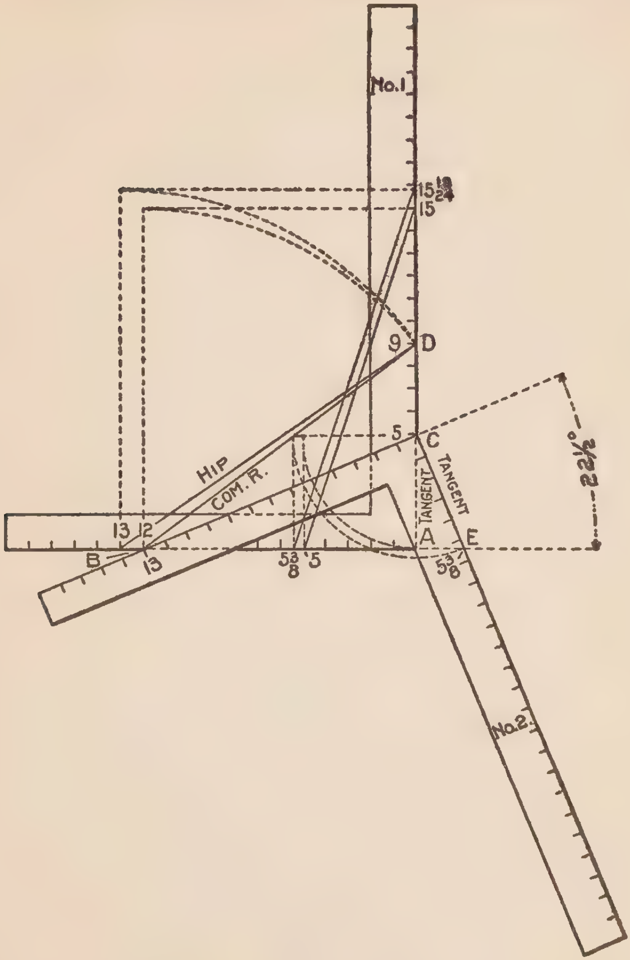


FIG. 3

that shown on No. 1. Then 13 and 9 will give the seat and plumb cuts of the octagon hip. The tangent of the common rafter is equal to 5 inches,

as A-C on No. 2. This transferred to No. 1, and the length of the common rafter transferred to the blade, will give the side cut of the octagon jack. The blade giving the cut. The tangent for the hip is equal to $5\frac{3}{8}$ inches, as shown at C-E on square No. 3, and this transferred to the tongue of square No. 4 and the length of the hip transferred to the blade will give the side cut across the unbacked hip.

Perhaps some may think that we use too many squares to illustrate the different angles. Very well, then we will try it with only two squares, as shown in Fig. 3. This is cutting the number down to one-half. Taking the same example as in the preceding figure all of the measurements are shown on the two squares. Like letters are used to represent the plan, and the description given in the former applies to this illustration. The measurements shown on No. 2 are transferred to No. 1, and are the same as given on the squares in the preceding illustration. Yet we fancy we hear some one say, "Why use two squares? Why not show all of these cuts on one square?" Very well, we will try it again. This time we will not on y show the figures to use to obtain the cuts, but will show why they are used.

In Fig. 4 is shown a semicircle divided into the degree divisions, however, only one-fourth of the divisions, or the space covered by 45 degrees, are required for any of the polygonal angled corners above four, as will be seen later on.

In the illustration 12 on the blade is resting

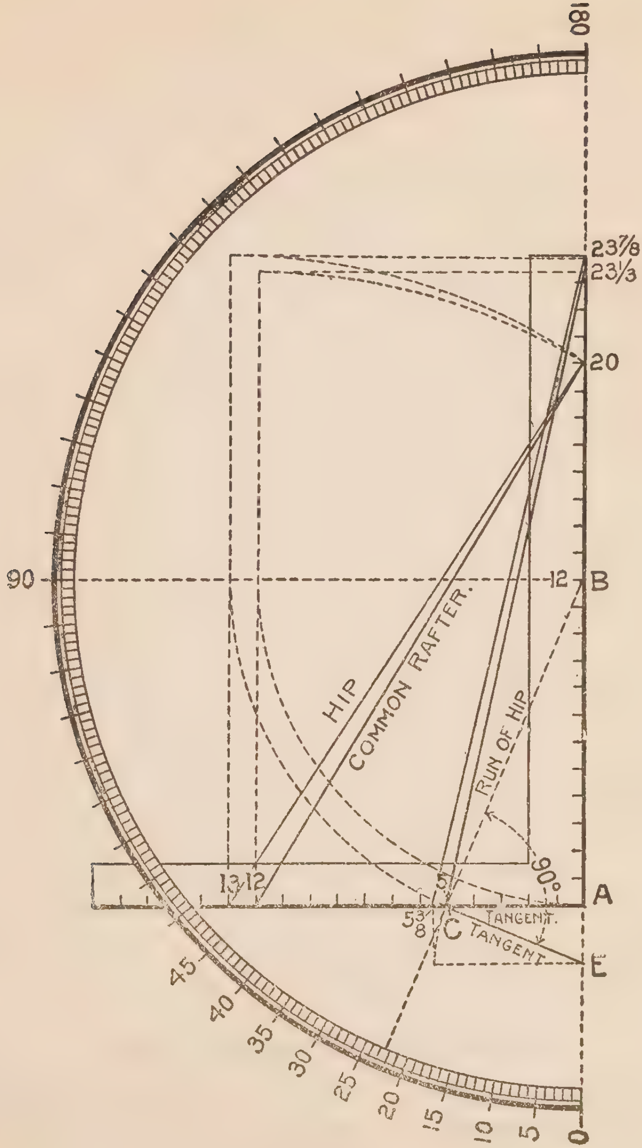

180
23⅞
23⅓
20
90
12
B
HIP
COMMON RAFTER.
RUN OF HIP
90°
13
12
5
A
5⅜
C
TANGENT.
TANGENT
E
45
40
35
30
25
20
15
10
5
0

FIG. 4

at the center of the circle and with the edge of the blade in line with the 180 degrees, as shown. Now, since the octagon has eight sides, we divide 180 by 8 and we find the quotient to be $22\frac{1}{2}$, which represents the angle in degrees of the run of the hip from that of the common rafter, and by drawing a line from 12 to the $22\frac{1}{2}$ division on the circle it will be seen that the line will pass at practically 5 inches on the tongue. From this point back to 12 represents the length of the run of the hip, while that from the heel to 12 represents the same for that of the common rafter. These lengths transferred to the tongue are found to be 13 and 12 respectively, and are the points to use on that member for the seat cuts. (Bear in mind that these figures are fixed points and remain so, regardless of the pitch given the roof.) Consequently these figures also represent the starting point for the pitch of these rafters, which we will assume to be a 20-inch rise, or 5-6 pitch. Lines then from 12 and 13 to 20 represent their slope in the roof, and their lengths transferred to the blade are shown to be 23 1-3 and $23\frac{7}{8}$ respectively. Here are all of the figures given on the square for the cuts as described in the previous figures, except in this, the pitch has been changed but the operation remains the same.

Constructing an Ordinary Stair.

Question: How would you build a stairway having a stretch-out stringer at the start and a quadrant between two flights?

Answer: In Fig. 1 is exhibited a plan of a stairway which represents a class that may be seen in any city and almost any village all over the country, yet few are the number of even

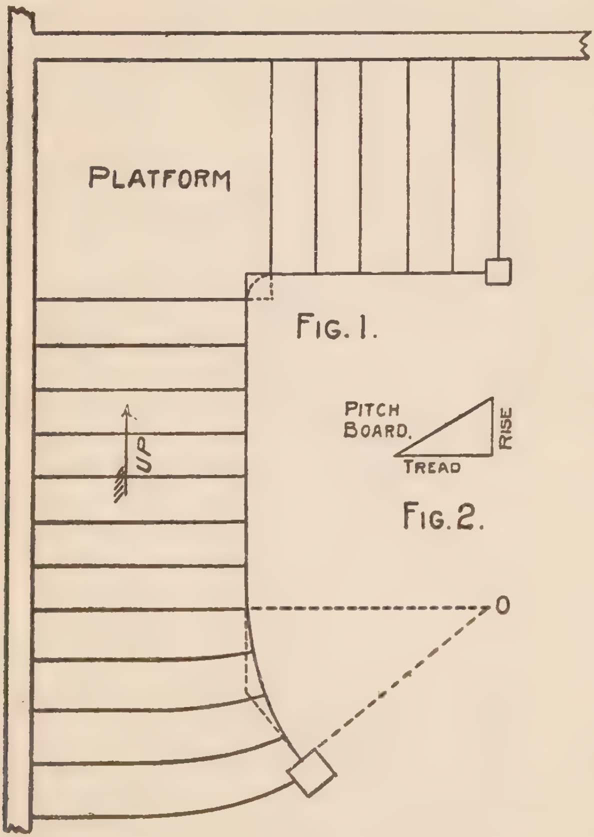


FIG. 1.

FIG. 2.

those carpenters reputed to be first-class mechanics that are capable of executing a job like this to their own and their employers' satisfaction.

In this article we propose to explain as lucidly

as the nature of such construction will admit, the laying out of all the details from the beginning to the end; so that any carpenter of ordinary intelligence may be able to go ahead with confidence of a successful issue.

The first requisite will be the pitch board which is shown in Fig. 2 to be a right angle triangle; the base representing the exact dimension

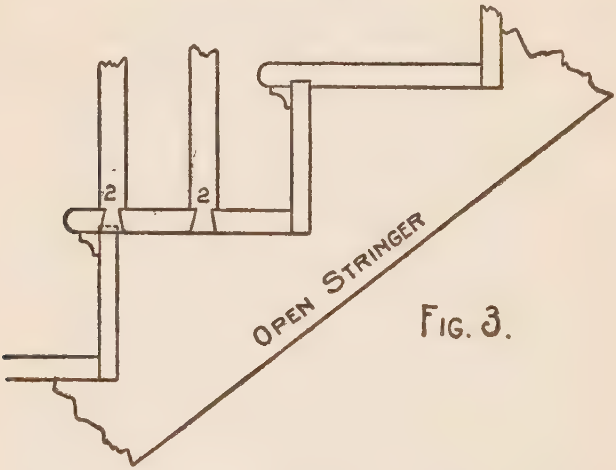


FIG. 3.

of the tread, and the altitude or height the exact dimension of the riser. It is generally made out of a piece of one-inch pine board, and too much care cannot be taken to secure the exact dimensions for the treads and risers; which depends upon the run and rise of the stairway.

What is meant by the rise is the distance from floor to floor. In this instance it is 10 feet 6 inches, or 126 inches. By dividing 126 inches by 18, we will obtain a quotient of 7 inches, which is the

exact dimension of each riser and in the complete structure we will have 18 of them. In ordinary stairways a 7-inch riser may be considered a very satisfactory limit to guarantee an easy stepping in ascending and descending.

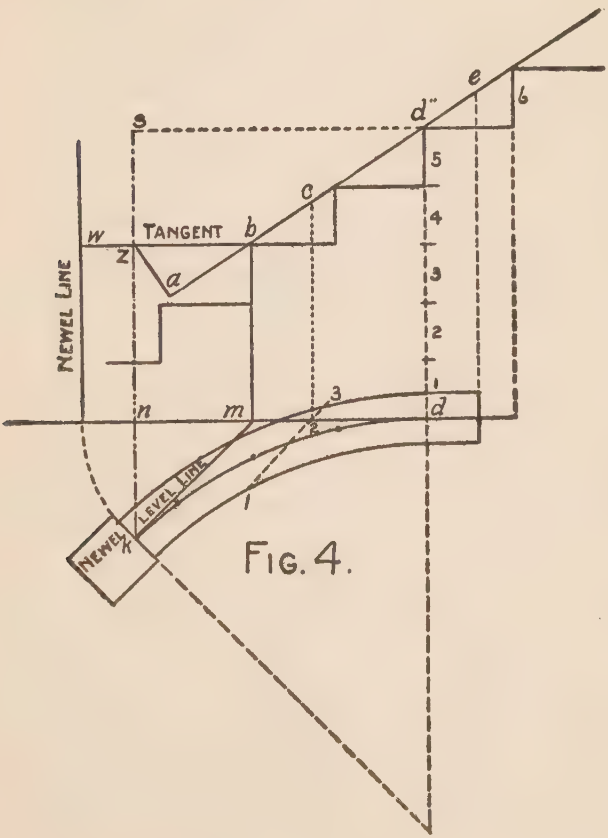


FIG. 4.

A proportional tread for a riser 7 inches wide may be found by dividing the number 66 by 7,

which equals 9 3-7 inches, which is the best proportional width of tread for a 7-inch riser.

With these dimensions for tread and riser, we will now cut out the pitch-board off a piece of an inch board; and mark 18 on the edge representing the risers, and 17 on the edge representing the tread.

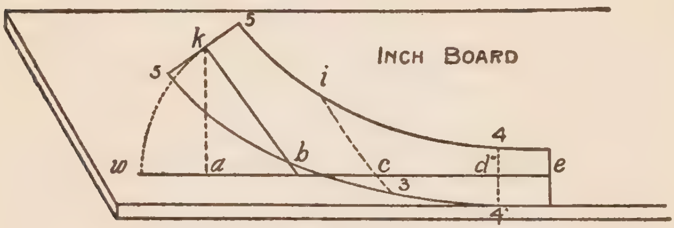


FIG. 5.

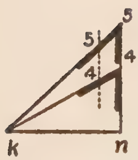


FIG. 6.

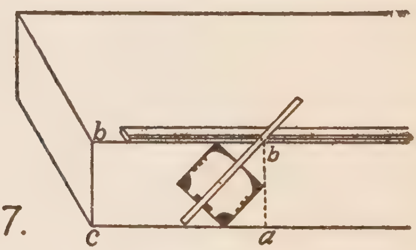


FIG. 7.

This will help memorizing the number of treads and risers required which, in course of construction, will be found of some advantage as it will minimize the danger of cutting the stringers too short.

With the pitch-board as a template the next process will to be mark the housings, or grooves, on the wall stringer and also on the front stringer

which, generally in stairways of this class, is cut out instead of being grooved.

In workshop parlance, the grooved stringer is called the "closed stringer," and the cut stringer is known as the "open stringer." The constructive principle of the open stringer is considered superior to that of the closed stringer in stairways having continuous rails, where the winding wreaths

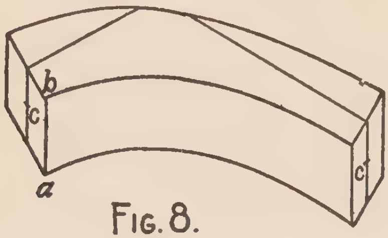


FIG. 8.

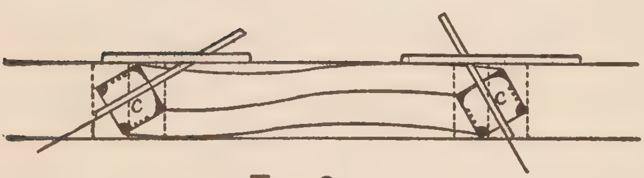


FIG. 9.

take the place of newels, causing the rail to depend absolutely for its stability on the strength that may be secured by the best means available of fastening the balusters to the rail and stringers.

In open stringers the balusters are always dovetailed to the end of the treads, as shown at 2 and 2 in Fig. 3, a method of construction if executed with care and when put together with good glue, and a nail or two, will hold the rail as fast as if held between newels; while with closed

stringers there is no way of execution other than nailing the bottom of the balusters to the top edge of stringer, a method, however well it may be done, will never accomplish the purpose of securing a stable and rigid rail.

The stretch-out portion of the stringer as shown in Fig. 1, is described from the center; and the curve is made to continue four steps; equally divided; so as to obtain the same pitch for the wreath as that of the straight rail, which is an arrangement that should always be adhered to, as it gives the finished rail a more pleasing appearance, and saves a great deal of extra labor in the manipulation of the wreath.

An elevation of these steps above the plan of the curved rail is shown in Fig. 4, where the pitch line of the straight rail is shown continued to point b over two of them; and from b a level tangent line is shown extending to intersect a perpendicular line representing the side of the newel post at w.

From k in the plan another perpendicular line is drawn to 1s, intersecting the line bw in z; and from z a line is drawn to a square to the pitch line a, b, c, d, e.

In the plan is shown a line 1-2-3 drawn parallel to the plan level tangent km; and from 2 a perpendicular line is drawn to cut the pitch line in c.

Now we are ready to draw the face mold, which is shown in Fig. 5. A piece of an inch board is procured large enough to contain the mold;

one edge of it is planed straight, and a line gauged from this edge at a distance a little more than one-half the width of the plain rail.

To this line is transferred the points on the pitch line in Fig. 4, as shown at a, b, c, d, e. The point w indicates the length from b equal to the length b w, which is the level tangent shown in

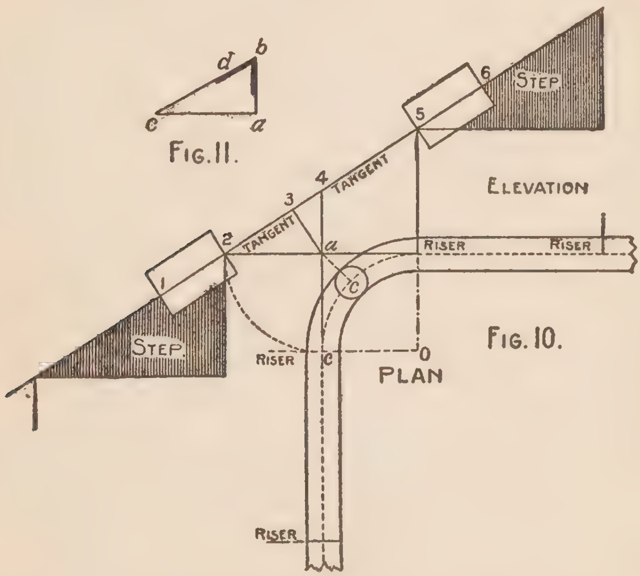


Fig. 4. Upon b erect the perpendicular line b k; place leg of the compasses in b; extend the other to w; turn over to k; and connect k b; which will be the level tangent as it is required on the face mold.

Make the joint at k square to this tangent and the joint at e square to the line b, c, d, e, which is the other tangent required on the face mold. Now

draw the line 1, c, 3 parallel to the tangent b, k; and make it equal to the line 1, 2, 3 shown in the plan Fig. 4.

In Fig. 6 is shown two levels that are required; to twist the wreath, one for each end, and one forward as follows:

Make k n equal to k n in Fig. 4; n 4 equal to z a Fig. 4; connect 4 k; the level is at 4, and is to be applied to the end e of the wreath. The distance 4-4 is to be applied on each side of d″ on the mold, as shown in Fig. 5, which determines its width at this end.

Again in Fig. 6 make n 5 equal to z s in Fig. 4, and connect 5 k, the bevel is shown at 5.

The distance 5, 5, taken from this bevel and placed on each side of k on the mold in Fig. 5, will determine the width of the mold at this end; and by bending a lath to touch points 5, 1, 4, the inside curve of the mold may be described; so also by bending a lath to touch points 5, 3, 4, the inside curve is described; thus completing the form of the face mold.

We will now need to know what thickness of plank will be required for the wreath.

In Fig. 7 is shown how this may be found.

Where there are two bevels as in the case under consideration, select the largest of the two; and as shown in Fig. 7, draw a square section of the rail parallel to the blade; the distance a b, as shown in this figure, indicates the thickness of plank required. Now place the face mold on a piece of plank of such thickness, and cut out the

form shown in Fig. 8, square to the face of plank, and cut the joints also square to the face and square to the tangents. Find the center of each joint, as at c and c, and place the bevels to cut the centers, as shown at c and c in Fig. 9, which illustrates the wreath as it will appear after it is squared ready for the molding.

In Fig. 10 is exhibited the plan and elevation of the quadrant shown in Fig. 1, at the junction of the two flights adjacent to the platform. There

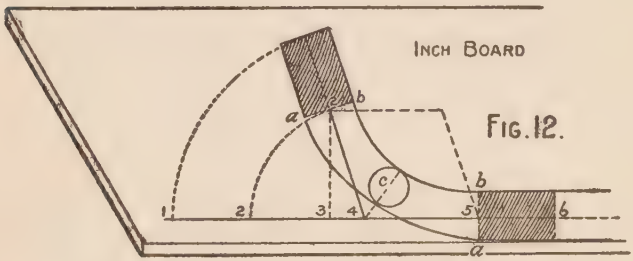


FIG. 12.

is nothing in this figure that needs explanation, except the line 3 a, which is drawn square to the pitch line of the rail from a. The pitch line of the two tangents is shown to align with the pitch of rail; as from 2 to 5.

One bevel only will be required for this wreath because the tangents are equally inclined and it is to be applied to each end owing to both being inclined. If one was level, the bevel would be applied only to one end. This applies to cases where the plan tangents stand at right angles to one another as in this instance.

The bevel is found as shown in Fig. 11 where c a equals the length of the plan tangent c a; and a b equals the line 3 a, which as already stated is made square to the pitch line of the tangents.

The face mold is exhibited in Fig. 12 and is drawn precisely as the face mold for the stretch-out wreath, shown in Fig. 5, was drawn.

In Fig. 12 the points 1, 2, 3, 4, 5, 6 are transferred from the pitch line in Fig. 10. On 3 a perpendicular line 3, 2″ is drawn; then one leg of the compasses is fixed in 4, the other extended to 2 and turned over to 2″. By connecting 2″ to 4 we fix the position of the tangent 2″ 4 as it is required on the face mold; the other tangent being 4, 5. The joints are made square to these tangents, respectively.

The shaded portions shown at each end are known as the "shanks," being, as they are, outside the curve of the mold, they do not properly belong to the wreath.

Fig. 13 exhibits a plan of the cylinder where it is shown to be constructed of three pieces jointed, screwed and glued together, the inside being worked to the curve of the well. It is connected to the stringers as shown by being notched and screwed.

In Fig. 14 a method is shown to draw the "gooseneck" adjacent to the landing newel so that the "knee" will aline with the landing rail.

The bottom of the rail is shown resting on the nosing of the steps, and continued to 2 the center of the newel.

It is desired to have the landing rail at a height of 2 feet 8 inches from the floor to the under side of the rail, we will therefore place the landing rail, as shown, 6 inches above the floor line. By this arrangement it is evident that when the flight rail is raised to its position, 2 feet 2 inches above the nosing line, the landing rail will then be 2 feet 8 inches above the floor line. Con-

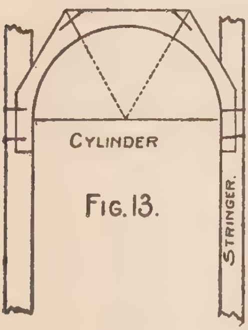


FIG. 13.

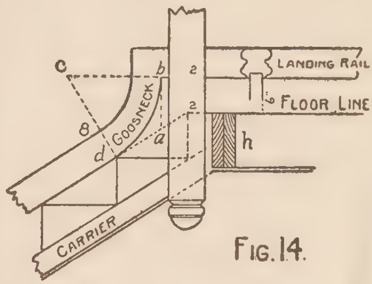


FIG. 14.

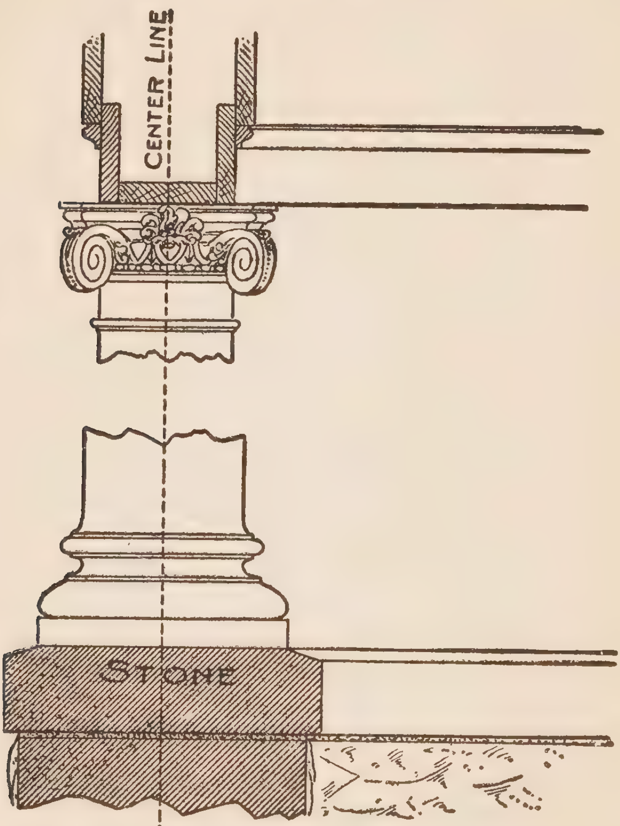
tinue the bottom of the landing rail to c; from b drop a line to a; make a d equal b a; take c from a center; c d for radius and describe the bottom curve; again take c for center c 8 for radius, and describe the upper curve. In this figure is shown a carrier under the stairway extending to the trimmer h; care should be taken to always fix the trimmer so as to be of use to support the end of the carrier.

How Wide Should be the Soffit?

I am looking for some information and have taken the liberty to ask you. Should the capital project outside of soffit? I claim, as long as the

rail is centered, it does not matter. I have built my soffit so that the forms of the capital do not project beyond the face of the soffit. Would you think it absolutely wrong?

Answer: Yes, it is wrong. According to the architectural orders, established by the Greeks



and Romans centuries ago, and upon which no one has been able to set up any better models, the soffit, at its narrowest part, should equal the

diameter of the neck of the column, as shown in the accompanying illustration, which shows that the soffit should be centered over the railing or coping. This is an error that occurs too frequently and sadly to the architectural effect of the house. The builder should know the size of the column that he expects to use, the difference in the diameters at each end, and frame his work accordingly. There is an established proportion based upon the diameter of the column running through all of the different parts, even to that of the main cornice and other parts of the house itself, and for the best effect should be rigidly followed.

Making Show Window Sash.

Question: Please tell me how to put plate glass in store windows? What should be put under the lower edge of the glass where it rests on the window sill? How should it be fastened at the bottom inside and out, and should pieces of lead or rubber be put under the glass? Should the moulding be put on the inside with nothing on the outside, leaving the lower edge of glass bare and showing the lead or rubber?

Answer: There are a number of ways of constructing store windows, and it is hard to say which is the better way. Cork or rubber is quite often used to put under the glass. Some use soft pine. Fig. 1 shows a form that the writer has used in his work, which has given very general satisfaction. In the better class of work the sill is covered with copper, letting the same extend back

far enough to form a drain on the inside. Three-inch copper dentils are soldered on the outside about six or eight inches apart, and the bearings

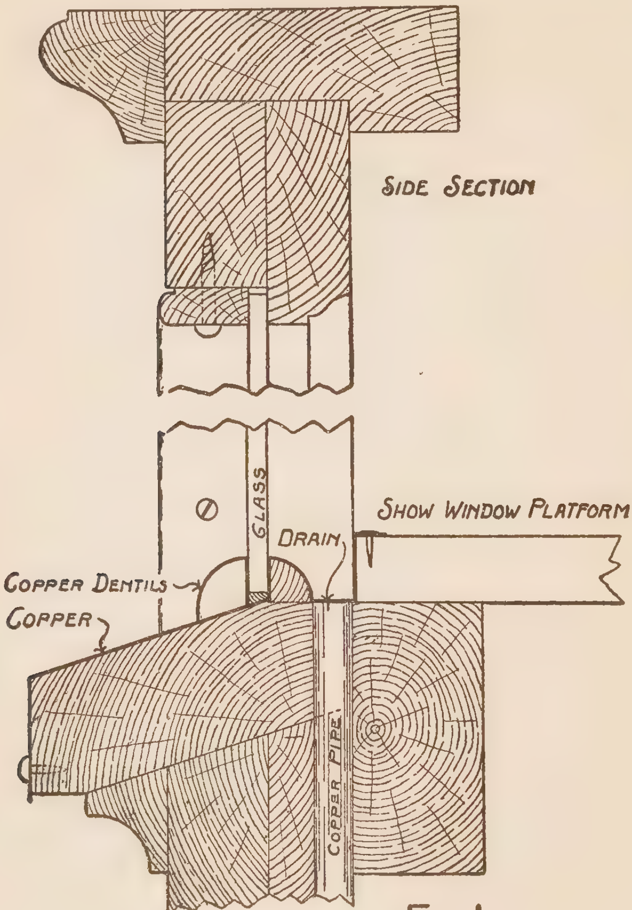
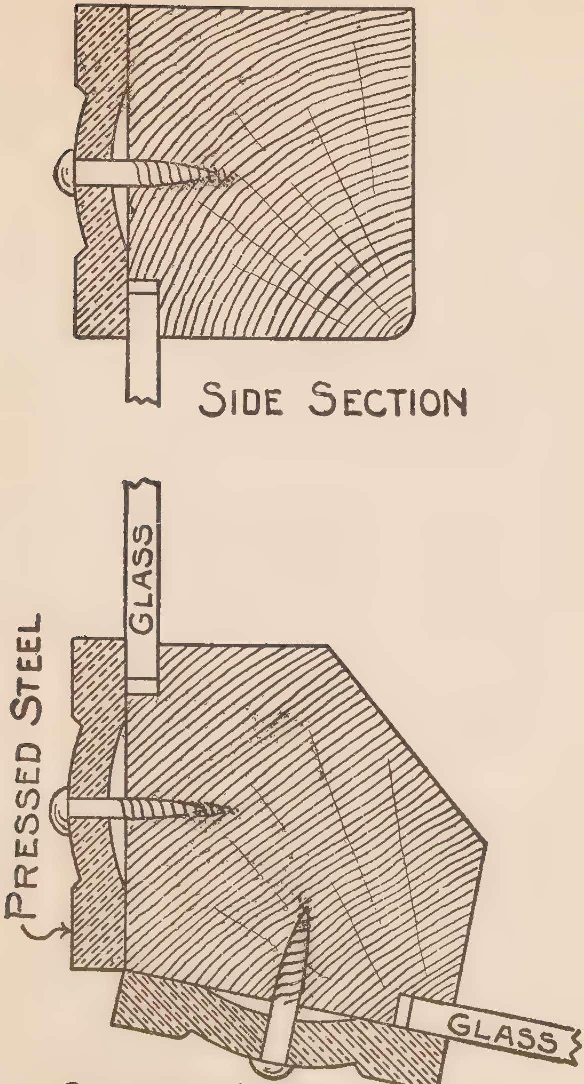


FIG. 1.

for the glass are placed back of the dentils, but none should be placed at or near the corners, as the weight will be liable to cause the glass to crack.



CORNER POST.

FIG. 2.

The side stops are placed on the outside and made secure with round-headed screws. The glass can then be set from the outside, which is much handier to get at, besides the wind pressure against the glass has a solid bearing against the frame itself, the members of which should be glued and put together with screws.

Fig. 2 shows another form quite generally used in the west. The frame work is of wood with the cross-pieces mortised into same and faced with pressed steel fronts of various ornamental patterns, which can be had through most any local hardware dealer. There are a number of patented devices for show window fronts, all possessing more or less good points, but the object in answering the above question is more to show how a satisfactory job may be had by the home workman.

Side Cuts of Various Rafters.

Question: Kindly show several methods of obtaining the side cuts of various rafters?

Answer: We have covered this point in other illustrations, but believe the subject is more clearly set forth in Fig. 1 than in any of the previous single illustrations. In this, 12 on the blade represents the central point from which the angles of the runs for the different polygons are reckoned. The lengths of the respective runs are transferred from the point where they intersect the tongue to a parallel line with the tongue, and at right angles with the starting point from the

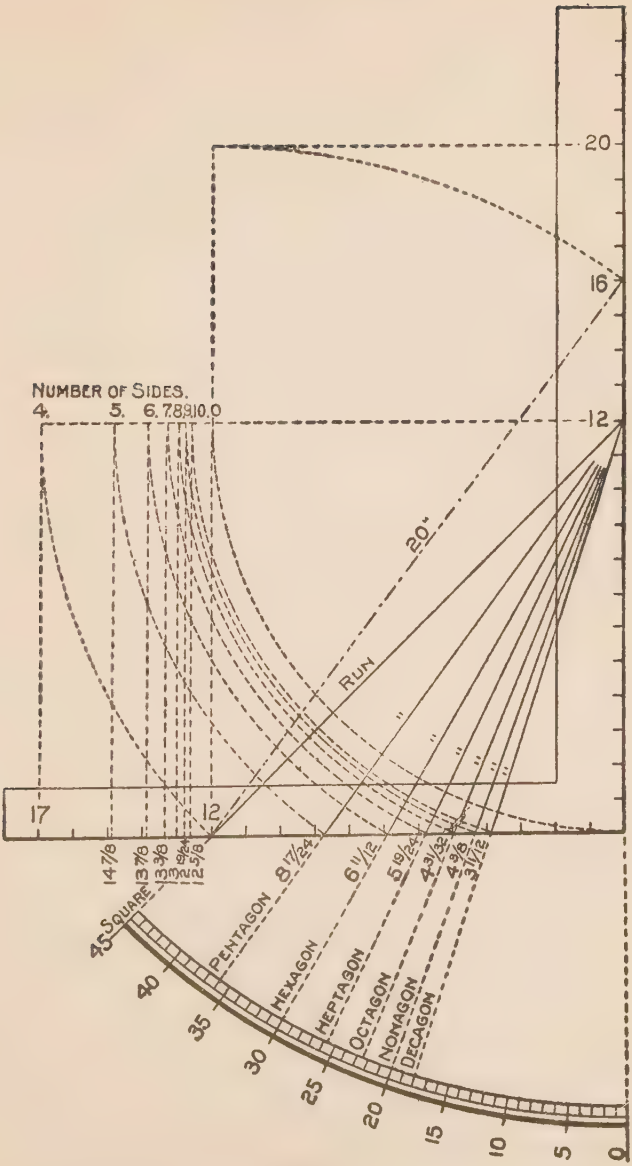

NUMBER OF SIDES.
4.
5.
6.
7.8.9.10.
0
20
16
12
20'
RUN
17
12
14 7/8
13 7/8
13 3/8
12 5/8
8 17/24
6 11/12
5 19/24
4 31/32
4 3/8
3 11/12
SQUARE
PENTAGON
HEXAGON
HEPTAGON
OCTAGON
NONAGON
DECAGON
45
40
35
30
25
20
15
10
5
0

FIG. 1

blade. The number of sides they represent are indicated on this line by the figures 4, 5, 6, etc. The perpendicular lines from these points to the tongue indicate the points to use on that member for the seat cuts of the different hips. These points, as will be seen, fall in between 12 and 17, and represent the length of the respective runs, with that for a one-foot run of the common rafter, while the figures from the heel to 12 represent the length of the tangents. Here is a beautiful study.

Note: The descent of the tangents is very rapid from 12 for the square down to 3 11-12 for the decagon, or ten-sided building. The more sides the shorter the tangent would be, until finally when they become so short that they are no longer recognized, then the building would be without hips. In other words, it would be round, and consequently its runs rest at zero and its length in 12 inches. This transferred to the parallel line intersects at 0, and the perpendicular line from this point intersects 12 on the tongue, thus showing that the rafters would be the same as for the common rafter for any kind of a building.

Note: There is only three-eighths of an inch difference between the length of run of the decagon and that for the common rafter. Therefore, no difference how many more sides the roof may contain, their lengths would fall in between 12 and $12\frac{3}{8}$ on the tongue. This will require pretty close calculation and accuracy on the part of the mechanic. However, it is very rare that examples of this kind come up in actual practice, and,

in fact, may never in a life time, but the theory is correct, and they are worked out along the same lines as for the more common angled corners, such as come up in every-day work.

The triangle is not shown in the illustration, yet it is indirectly represented. The reason for

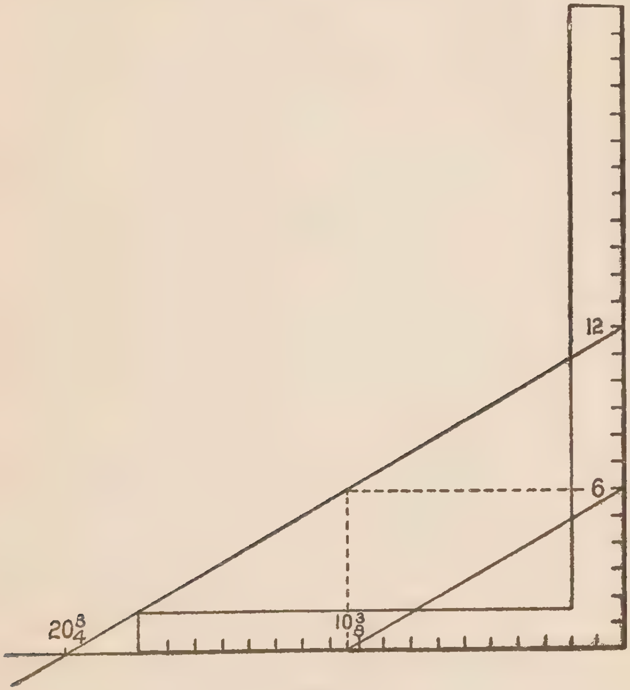


FIG. 2

this is, that the angle of the run falls into the cotangents. The quotient is found to be 60 degrees, and consequently would be beyond 12 on the tongue. In fact, it would not intersect the tongue at all, as its tangent is $20\frac{3}{4}$ inches. Therefore, it

would be necessary to reduce the scale as $10\frac{3}{8}$ and 6, which is a reduction of one-half; and these figures taken on the steel square will give the same results as $20\frac{3}{4}$ and 12.

To illustrate this point further we refer to Fig. 2. Here is the 60-degree line centering at 12, as in the case of the other examples. The intersecting point on the tongue would be at $20\frac{3}{4}$. Now, as this is beyond the length of the tongue, we must use some other figures. Say we wish to take one-half of the above proportions. Then square out 6 inches below 12 on the blade (because 6 is one-half of 12) to a point intersecting the 60-degree line, thence down to the tongue and the line will intersect $10\frac{3}{8}$, which is one-half of $20\frac{3}{4}$. A line from $10\frac{3}{8}$ to 6 will be parallel to the one above and will give the same results. For finding the side cuts, proceed from these points as in the previous figure.

However, we are not through talking about Fig. 1. 12 on the tongue is a pivotal point, because it represents the full scale, or in other words, 12 inches equals one foot. The pitches are reckoned from this point.

For example, we have taken the 2-3 pitch (16 on the blade), then the dotted line from 12 to 16 represents that pitch, and gives the seat and plumb cuts of the common rafter. For the corresponding hips for any of the polygons, it is 16 on the blade, and those for the respective number of sides on the tongue. For the side cut of the jacks it is the length of the common rafter

(20) transferred to the blade and the respective tangent on the tongue; the blade will give the proper angle for the cut. Thus for the side cut

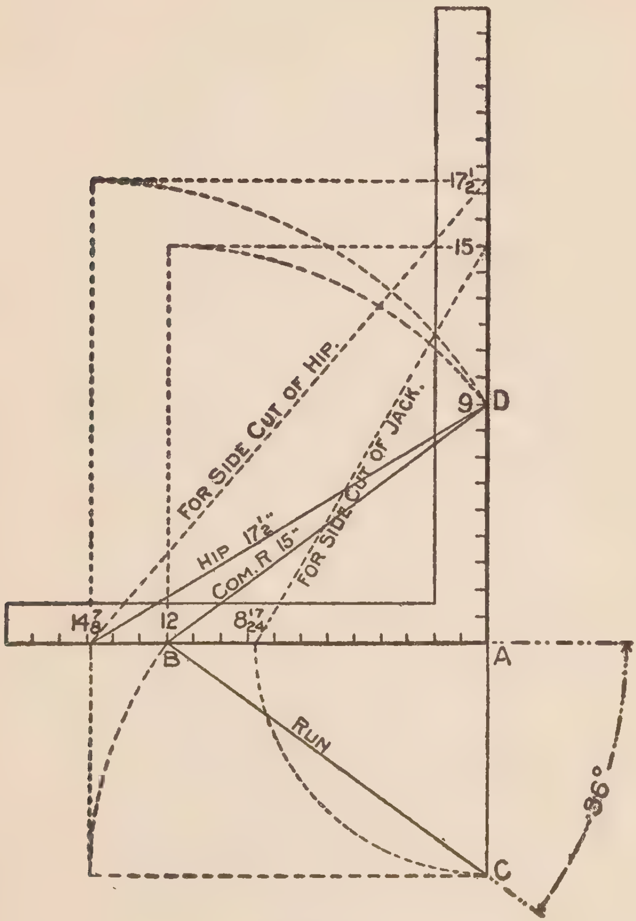


FIG. 3

of the octagon jack it would be 4 31-32 (practically 5) on the tongue and 20 on the blade.

We show in Fig. 3 the 9-inch rise, or 3-9 pitch. for illustrating purposes, and like letters are used to represent the different parts; besides, the dif-

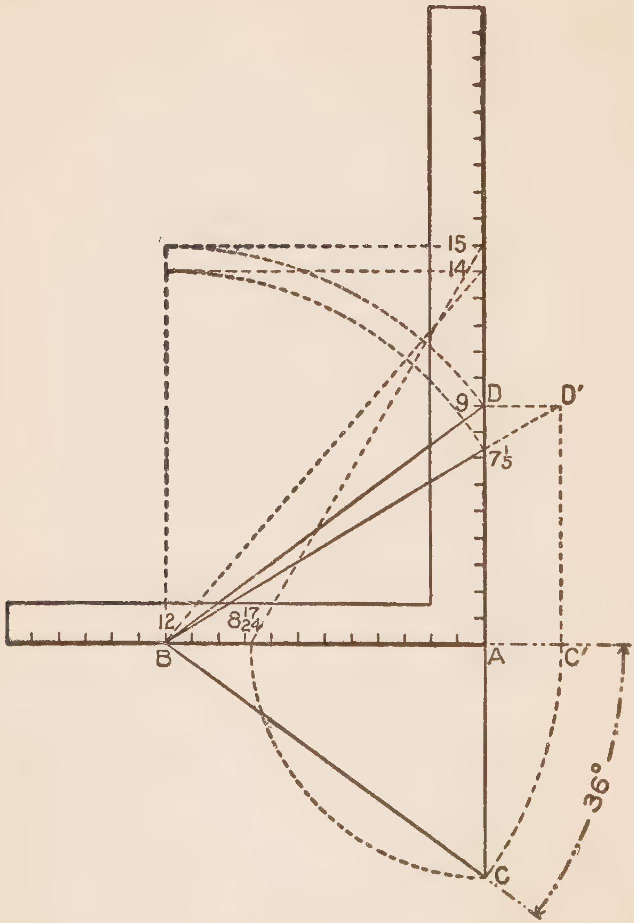


FIG. 4

ferent angles are clearly described, showing just what each angle is for, so that it is not necessary

to enter further into the description of this figure. However, it might be well to show how 12 on the tongue can be used for both the common rafter and hip and yet give the same results though different figures are used on the square to give the cuts for the hip. In other words, 12 and 7 1-5 (see Fig. 4) will give the same results as $14\frac{7}{8}$ and 9; and 12 and 14 will give the same as $14\frac{7}{8}$ and $17\frac{1}{2}$. But the length of the hip should be calculated as from 12 to D′ in comparison to one foot run of the common rafter. Otherwise, if the length is reckoned from 12 to 7 1-15, then this applies to each foot of its own run. As this would require an extra calculation to arrive at the lengths of the individual run of the hip, it is better to use the figures on the tongue (for the hip).

Index to Volume II.

Practical House Plans

WE ILLUSTRATE IN THIS BOOK the perspective view and floor plans of 50 low and medium-priced houses. In the preparation of this work great care has been exercised in the selection of original, practical and attractive house designs, such as seventy-five to ninety per cent of the people to-day wish to build. In drawing these plans special effort has been made to provide for the MOST ECONOMICAL CONSTRUCTION, thereby giving the home builder and contractor the benefit of the saving of many dollars; for in no case have we put any useless expense upon the building simply to carry out some pet idea. Every plan illustrated will show, by the complete working plans and specifications, that we give you designs that will work out to the best advantage and will give you the most for your money; besides every bit of space has been utilized to the best advantage.

$50.00 PLANS FOR ONLY $5.00 This department has for its foundation the best equipped architectural establishment ever maintained for the purpose of furnishing the public with complete working plans and specifications at the remarkably low price of only $5.00 per set. Every plan we illustrate has been designed by a licensed architect, who stands at the head of his profession in this particular class of work and has made a specialty of low and medium-priced houses. The price usually charged for this work is from $50.00 to $75.00.

WHAT WE GIVE YOU The first question you will ask is, "What do we get in these complete working plans and specifications? Of what do they

consist? Are they the cheap printed plans on tissue paper without details or specifications?" We do not blame you for wishing to know what you will get for your money.

BLUE PRINTED WORKING PLANS The plans we send out are the regular blue printed plans, drawn one-quarter inch scale to the foot, showing all the elevations, floor plans and necessary interior details. All of our plans are printed by electricity on an electric circular blue-printing machine, and we use the very best grade of electric blue-printing paper; every line and figure showing perfect and distinct.

FOUNDATION AND CELLAR PLANS This sheet shows the shape and size of all walls, piers, footings, posts, etc., and of what materials they are constructed; shows the location of all windows, doors, chimneys, ash-pits, partitions, and the like. The different wall sections are given, showing their construction and measurements from all the different points.

FLOOR PLANS These plans show the shape and size of all rooms, halls and closets; the location and size of all doors and windows; the position of all plumbing fixtures, gas lights, registers, pantry work, etc., and all the measurements that are necessary are given.

ELEVATIONS A front, right, left and rear elevation are furnished with all the plans. These drawings are complete and accurate in every respect. They show the shape, size and location of all doors, windows, porches, cornices, towers, bays, and the like; in fact, give you an exact scale picture of the house as it should be at completion. Full wall sections are given showing the construction from foundation to roof, the height of stories between the joists, height of plates, pitch of roof, etc.

ROOF PLAN This plan is furnished where the roof construction is at all intricate. It shows the location of all hips, valleys, ridges, decks, etc. All the above drawings are made to scale one-quarter inch to the foot.

DETAILS All necessary details of the interior work, such as door and window casings and trim, base, stools, picture moulding, doors, newel posts, balusters, rails, etc., accompany each set of plans. Part is shown in full size, while some of the larger work, such as stair construction, is drawn to a scale of one and one-half inch to the foot. These blue prints are substantially and artistically bound in cloth and heavy water-proof paper, making a handsome and durable covering and protection for the plans.

SPECIFICATIONS The specifications are typewritten on Lakeside Bond Linen paper and are bound in the same artistic manner as the plans, the same cloth and water-proof paper being used. They consist of from about sixteen to twenty pages of closely typewritten matter, giving full instructions for carrying out the work. All directions necessary are given in the clearest and most explicit manner, so that there can be no possibility of a misunderstanding.

BASIS OF CONTRACT The working plans and specifications we furnish can be made the basis of contract between the home builder and the contractor. This will prevent mistakes, which cost money, and they will prevent disputes which are unforeseen and never settled satisfactorily to both parties. When no plans are used the contractor is often obliged to do some work he did not figure on, and the home builder often does not get as much for his money as he expected, simply because there was no basis on which to work and upon which to base the contract.

NO MISUNDERSTANDING CAN ARISE when a set of our plans and specifications is before the contractor and the home builder, showing the interior and exterior construction of the house as agreed upon in the contract. Many advantages may be claimed for the complete plans and specifications. They are time savers and, therefore, money savers. Workmen will not have to wait for instructions when a set of plans is left on the job. They will prevent mistakes in cutting lumber, in placing door and window frames, and in many other places where the contractor is not on the work and the men have received only partial or indefinite instructions. They also give instructions for the working of all material to the best advantage.

FREE PLANS FOR FIRE INSURANCE ADJUSTMENT You take every precaution to have your house covered by insurance; but do you make any provision for the adjustment of the loss, should you have a fire? There is not one man in ten thousand who will provide for this embarrassing situation. You can call to mind instances in your own locality where settlements have been delayed because the insurance companies wanted some proof which could not be furnished. They demand proof of loss before paying insurance money, and they are entitled to it. We have provided for this and have inaugurated the following plan, which cannot but meet with favor by whoever builds a house from our plans.

IMMEDIATELY UPON RECEIPT OF INFORMATION from you that your house has been destroyed by fire, either totally or partially, we will forward you, free of cost, a duplicate set of plans and specifications, and in addition we will furnish an affidavit giving the number of the design and the date when furnished, to be used for the adjustment of the insurance.

WITHOUT ONE CENT OF COST TO YOU and without one particle of trouble. We keep a record of the number of the house design and the date it was furnished, so that, in time of loss, all it will be necessary for you to do is to drop us a line and we will furnish the only reliable method of getting a speedy and satisfactory adjustment. This may be the means of saving you hundreds of dollars, besides much time and worry.

OUR LIBERAL PRICES Many have marveled at our ability to furnish such excellent and complete working plans and specifications at such low prices. We do not wonder at this, because we charge but $5.00 for a more complete set of working plans and specifications than you would receive if ordered in the ordinary manner, and when drawn especially for you, at a cost of from fifty to seventy-five dollars. On account of our large business and unusual equipment, and owing to the fact that WE DIVIDE THE COST of these plans among so many, it is possible for us to sell them at these low prices. The margin of profit is very close, but it enables us to sell thousands of sets of plans, which save many times their cost to both the owner and the contractor in erecting even the smallest dwelling.

OUR GUARANTEE Perhaps there are many who feel that they are running some risk in ordering plans at a distance. We wish to assure our customers that there is no risk whatever. If, upon receipt of these plans, you do not find them exactly as represented, if you do not find them complete and accurate in every respect, if you do not find them as well prepared as those furnished by any architect in the country, or any that you have ever seen, we will refund your money upon the return of the plans from you in perfect condition. All of our plans are prepared by architects standing at the head of their profession, and

the standard of their work is the very highest. We could not afford to make this guarantee if we were not positive that we were furnishing the best plans put out in this country, even though our price is not more than one-seventh to one-tenth of the price usually charged.

BILL OF MATERIAL We do not furnish a bill of material. We state this here particularly, as some people have an idea that a bill of material should accompany each set of plans and specifications. In the first place, our plans are gotten up in a very comprehensive manner, so that any carpenter can easily take off the bill of material without any difficulty. We realize that there are hardly two sections of the country where exactly the same kinds of materials are used, and, moreover, a bill which we might furnish would not be applicable in all sections of the country. We furnish plans and specifications for houses which are built as far north as the Hudson Bay and as far south as the Gulf of Mexico. They are built upon the Atlantic and Pacific Coasts, and you can also find them in Australia and South Africa. Each country and section of a country has its peculiarities as to sizes and qualities; therefore, it would be useless for us to make a list that would not be universal. Our houses, when completed, may look the same whether they are built in Canada or Florida, but the same materials will not be used, for the reason that the customs of the people and the climatic conditions will dictate the kind and amount of materials to be used in their construction.

ESTIMATED COST It is impossible for anyone to estimate the cost of a building and have the figures hold good in all sections of the country. We do not claim to be able to do it. The estimated cost of the houses we illustrate is based on the most favorable conditions in all respects and includes everything but the plumbing and

heating. We are not familiar with your local conditions, and, should we claim to know the exact cost of a building in your locality, a child would know that our statement was false. We leave this matter in the hands of the reliable contractors, for they, and they alone, know your local conditions.

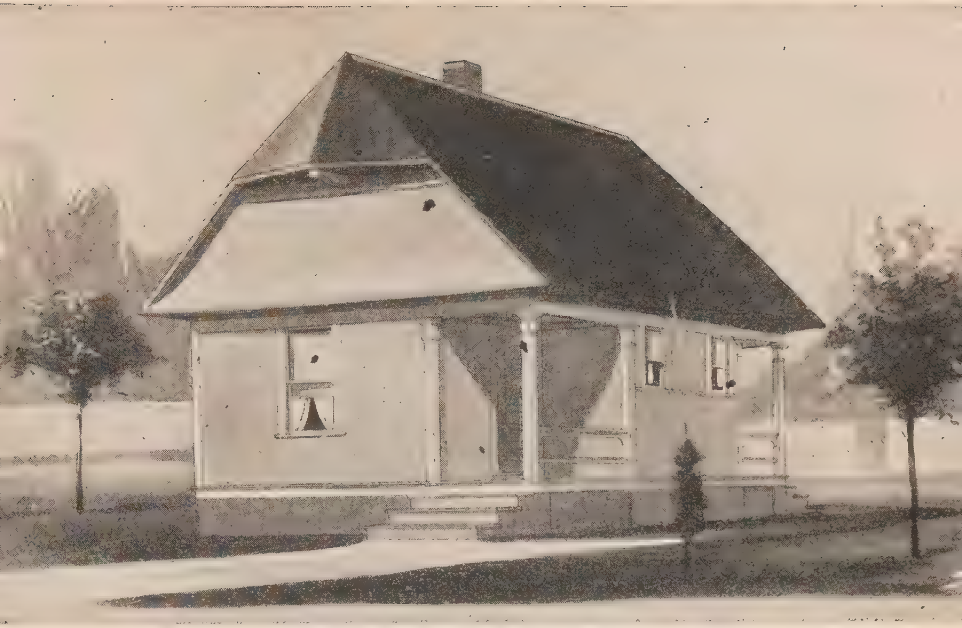
WE WISH TO BE FRANK WITH YOU and therefore make no statement that we cannot substantiate in every respect. If a plan in this book pleases you; if the arrangement of the rooms is satisfactory, and if the exterior is pleasing and attractive, then we make this claim—that it can be built as cheaply as if any other architect designed it, and we believe cheaper.

WE HAVE STUDIED ECONOMY in construction, and our knowledge of all the material that goes into a house qualifies us to give you the best for your money. We give you a plan that pleases you, one that is attractive, and one where every foot of space is utilized at the least possible cost. Can any architect do more, even at seven to ten times the price we charge you for plans?

REVERSING PLANS We receive many requests from our patrons for plans exactly according to the designs illustrated, with the one exception of having them reversed or placed in the opposite direction. It is impossible for us to make this change and draw new plans, except at a cost of about eight times our regular price. We see no reason why our regular plans will not answer your purpose. Your carpenter can face the house exactly as you wish it, and the plans will work out as well facing in one direction as in another. We can, however, if you wish, and so instruct us, make you a reversed blue print and

furnish it at our regular price; but in that case all the figures and letters will be reversed and, therefore, liable to cause as much confusion as if your carpenter reversed the plan himself while constructing the house.

WE WOULD ADVISE however, in all cases where the plan is to be reversed, and there is the least doubt about the contractor not being able to work from the plans as we have them, that two sets of blue prints be purchased, one regular and the other reversed, and in such cases we will furnish two sets of blue prints and one set of specifications for only fifty per cent added to the regular cost, making the $5.00 plan cost only $7.50.



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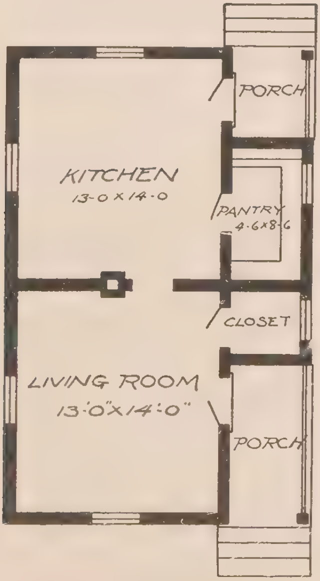

Floor Plan

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Size: Width, 19 feet; length, 29 feet 6 inches

Blue prints consist of foundation plan; floor plan; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

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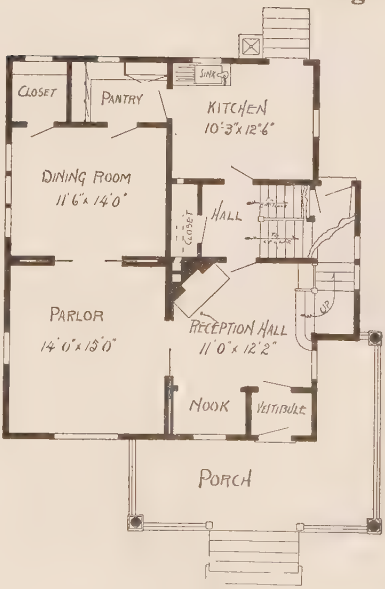
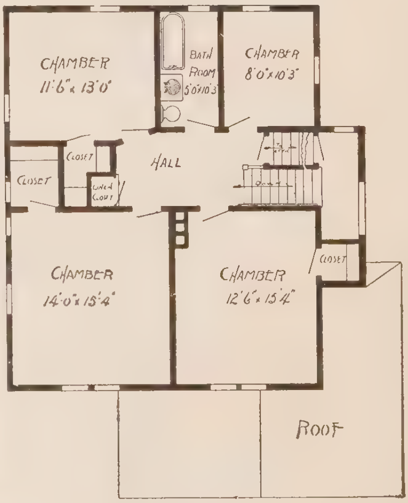


First Floor Plan



Second Floor Plan

Size: Width, 31 feet 6 inches; length, 34 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,400.00 to about $2,650.00, according to the locality in which it is built.

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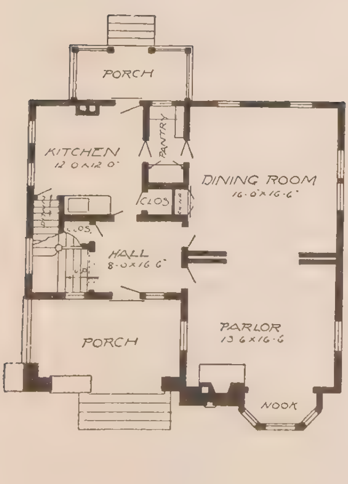
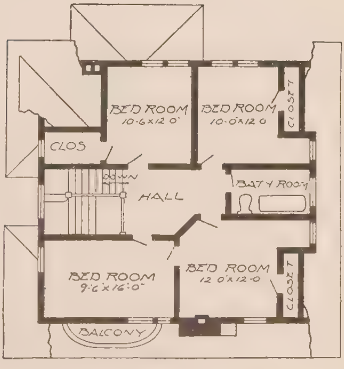


First Floor Plan



Second Floor Plan

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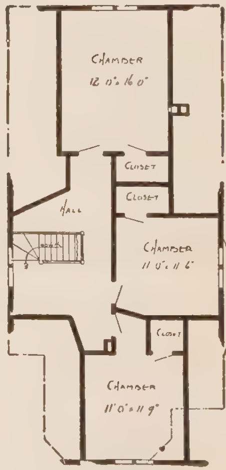
First Floor Plan



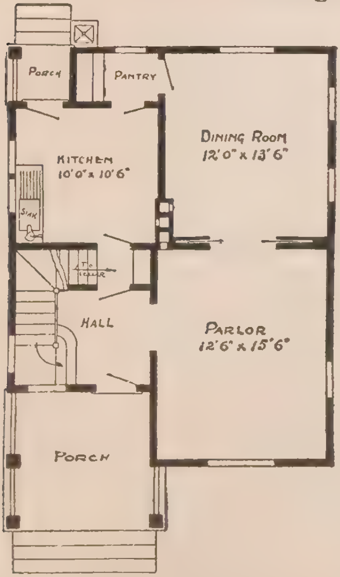
Second Floor Plan

Size: Width, 25 feet 6 inches; lengtn, 51 feet 6 inches, exclusive of porches

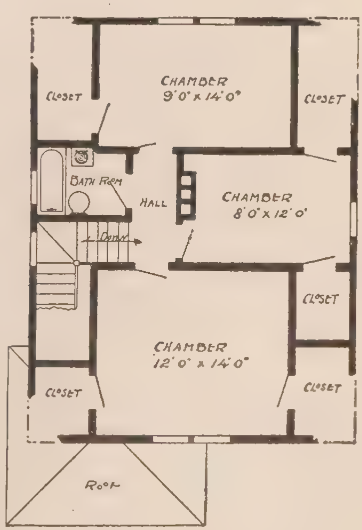
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,050.00 to about $1,200.00 according to the locality in which it is built.

Design No. 1115



First Floor Plan



Second Floor Plan

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Size: Width, 24 feet; length, 31 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $950.00 to about $1,125.00, according to the locality in which it is built.

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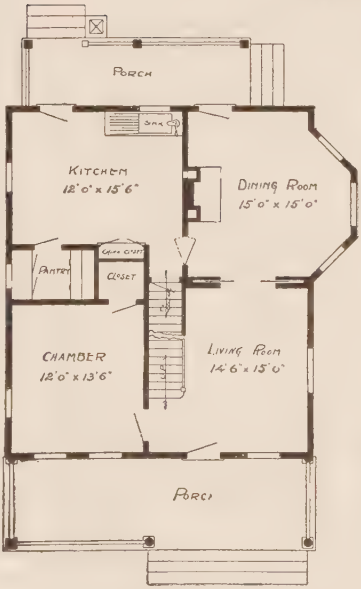
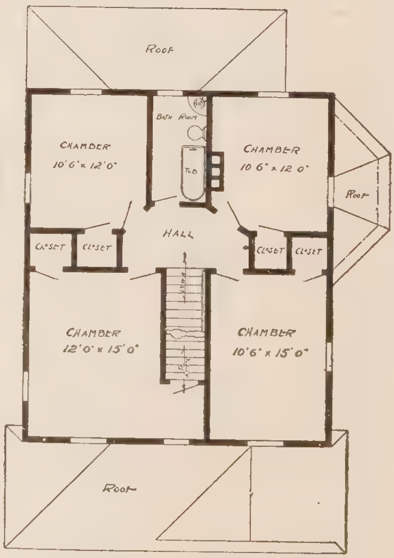


First Floor Plan



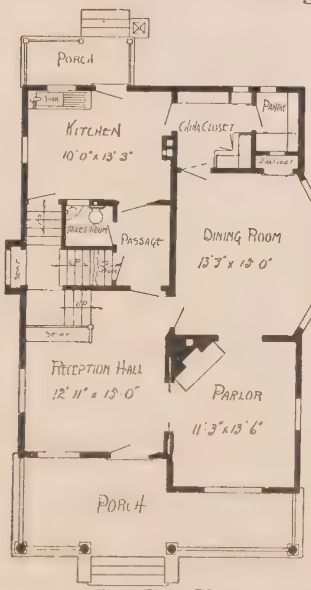
Second Floor Plan

Size: Width, 28 feet; length, 32 feet, exclusive of porches

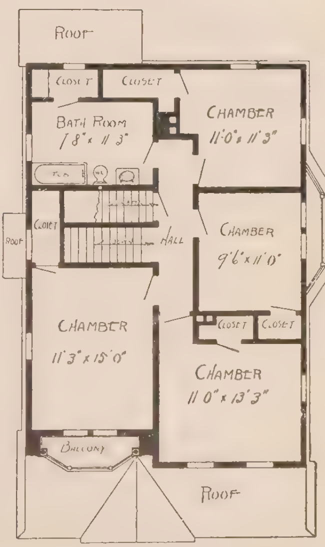
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1.950.00, according to the locality in which it is built.

Design No. 1122



First Floor Plan



Second Floor Plan

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Full and complete working plans and specifications of this house will be furnished for $6.50. Cost of this house is from about $2,100.00 to about $2,300.00, according to the locality in which it is built.

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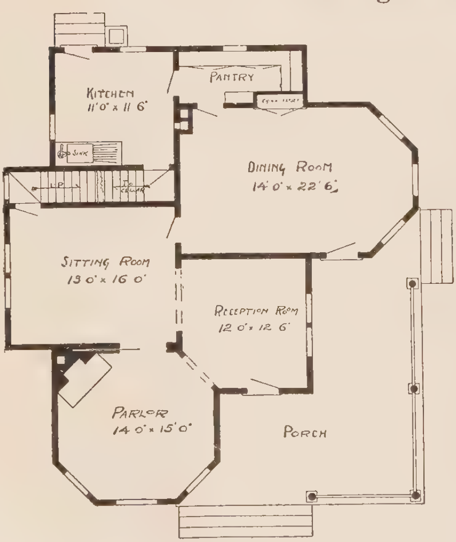
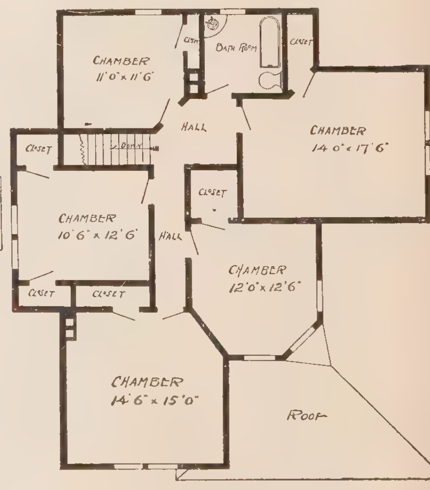


First Floor Plan



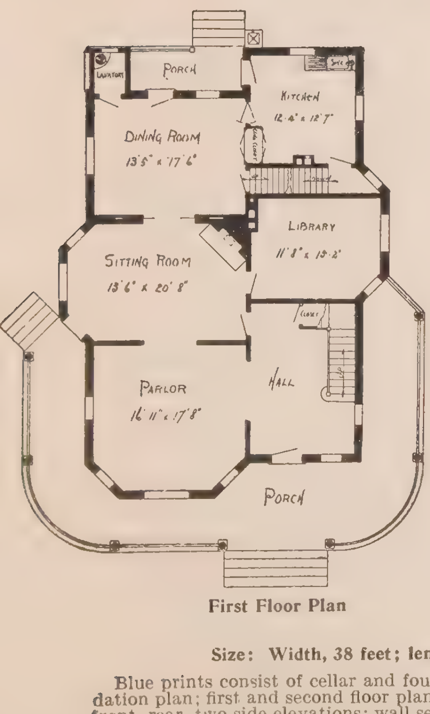
Second Floor Plan

Size: Width, 40 feet; length, 43 feet 6 inches, exclusive of porch

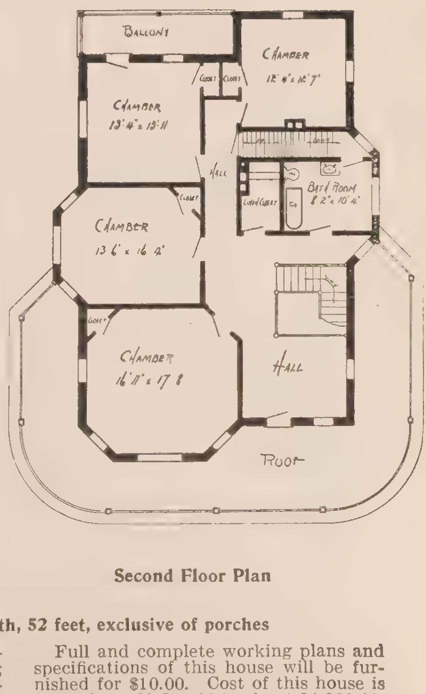
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,925.00 to about $2.150.00, according to the locality in which it is built.

Design No. 1132



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

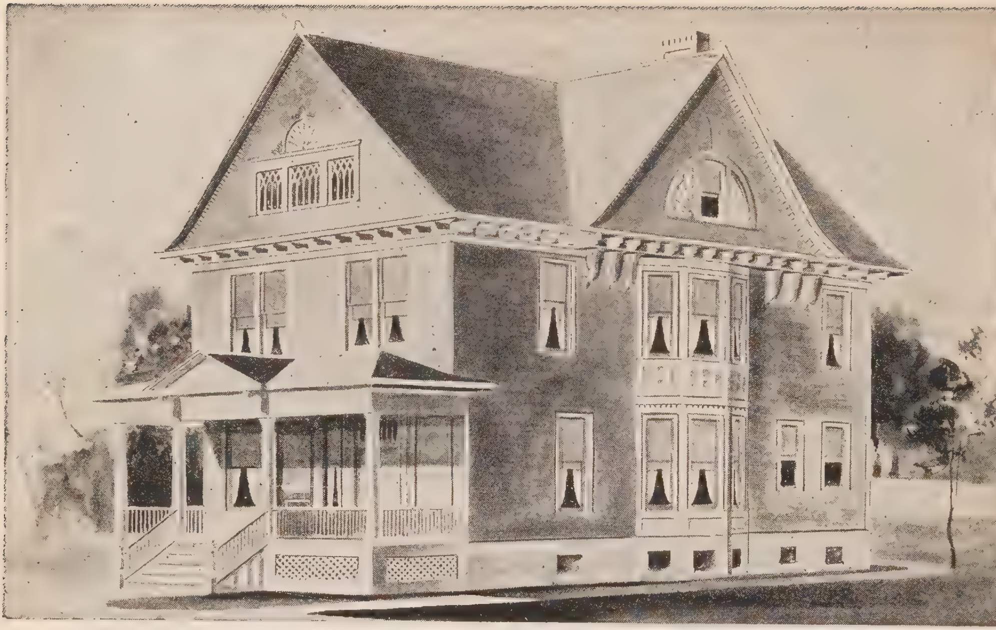
$10.00

They save time and prevent waste of material

Size: Width, 38 feet; length, 52 feet, exclusive of porches

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $10.00. Cost of this house is from about $3,800.00 to about $4,200.00, according to the locality in which it is built.



Design No. 1144

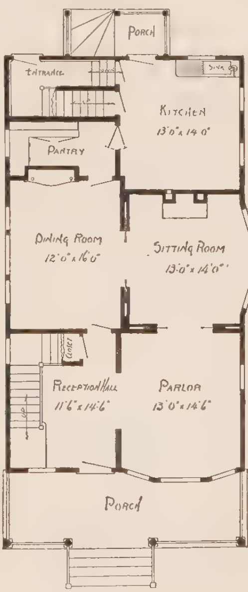
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

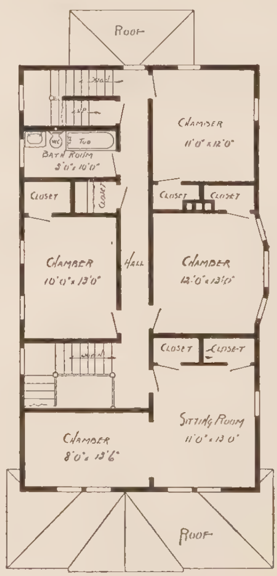
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



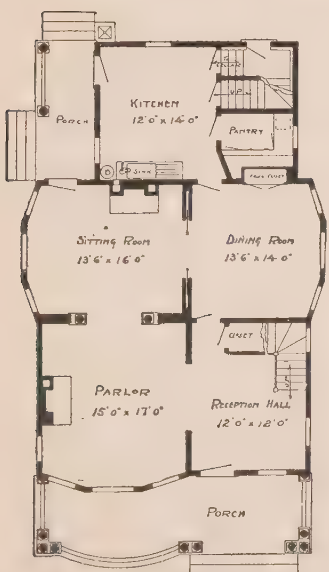
Second Floor Plan

Size: Width, 26 feet; length, 45 feet, exclusive of porches

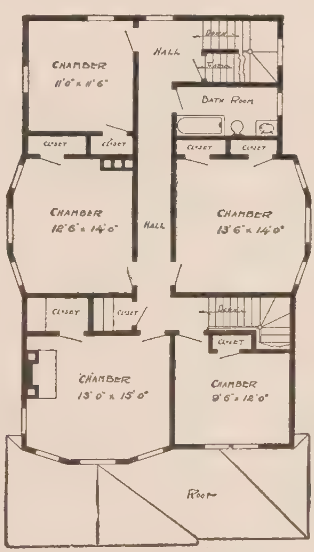
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,750.00 to about $3,000.00, according to the locality in which it is built.

Design No. 1118



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$8.00

They save time and prevent waste of material

Size: Width, 31 feet 6 inches; length, 47 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $8.00. Cost of this house is from about $2,900.00 to about $3,200.00, according to the locality in which it is built.

Design No. 1135

PRICE

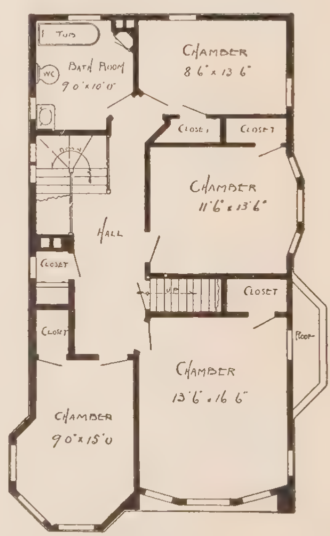
of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$7.50

They save time and prevent waste of material

First Floor Plan



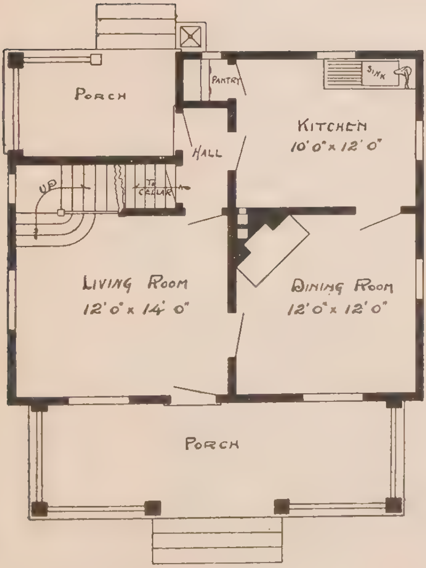
Second Floor Plan

Size: Width, 29 feet; length, 47 feet

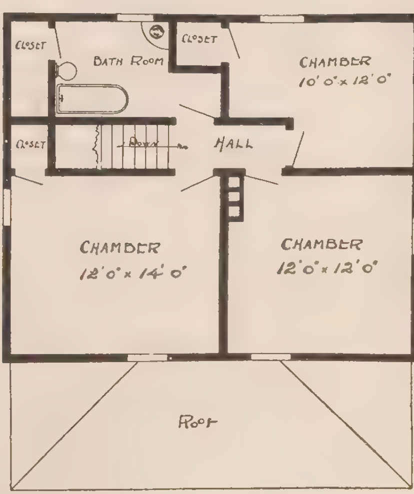
Blue prints consist of cellar and foundation plan; attic and roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about 20 pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $7.50. Cost of this house is from about $2,350.00 to about $2,600.00, according to the locality in which it is built.

Design No. 1117



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of type written specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 27 feet 6 inches; length, 23 feet 6 inches, exclusive of porches

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250 00 to about $1.450.00, according to the locality in which it is built.

Design No. 1143

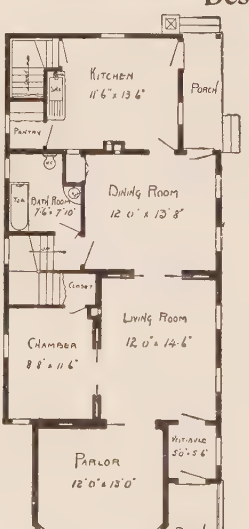
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material



First Floor Plan

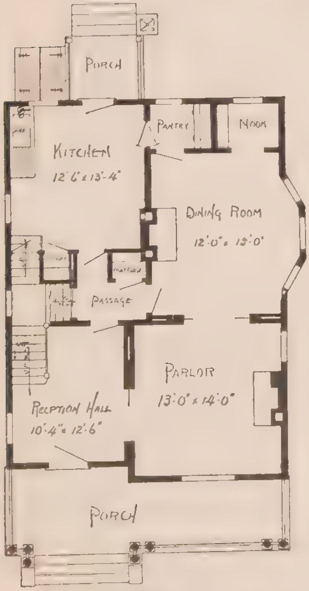
Second Floor Plan

Size: Width, 22 feet 6 inches; length, 53 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,450.00 to about $1,600.00 according to the locality in which it is built.

Design No 1134



First Floor Plan

Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 26 feet; length, 35 feet 6 inches, exclusive of porches

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1.850.00 to about $2,125.00, according to the locality in which it is built.

Design No. 1131

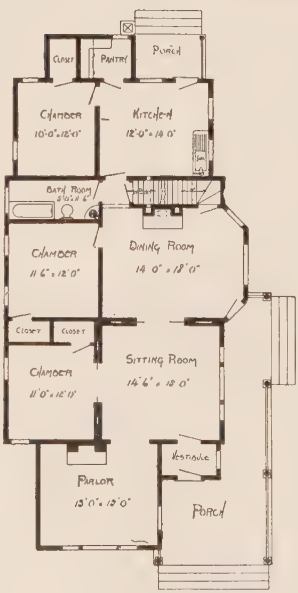
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

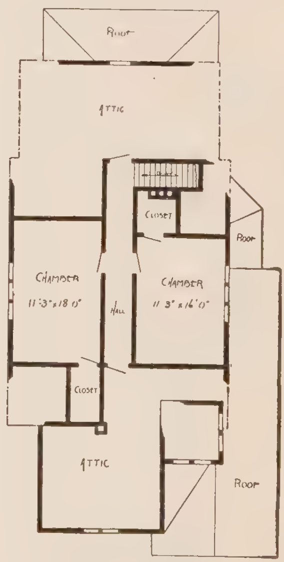
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



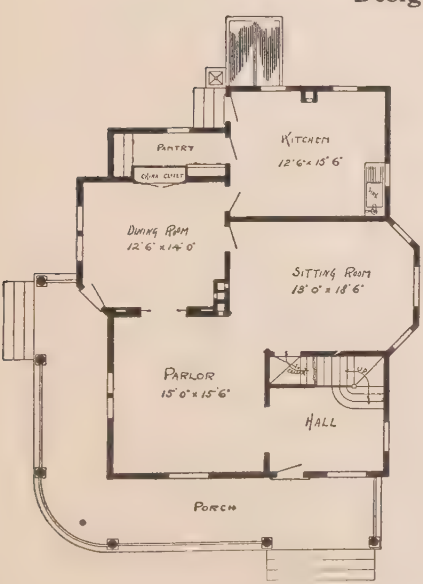
Second Floor Plan

Size: Width, 31 feet; length, 60 feet, exclusive of porch

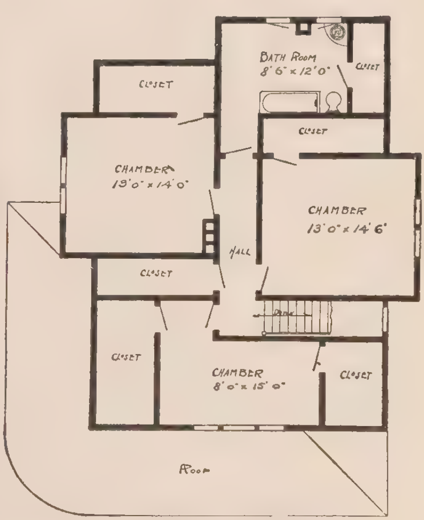
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1.550.00 to about $1,750.00, according to the locality in which it is built.

Design No. 1111



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 34 feet; length, 39 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,625.00 to about $1,850.00, according to the locality in which it is built.

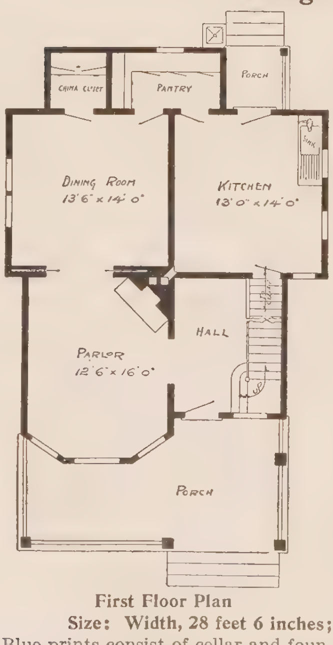
Design No. 1110

PRICE
of Blue Prints, together with a complete set of typewritten specifications is

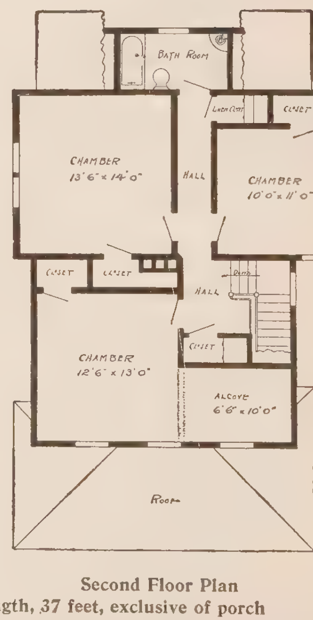
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



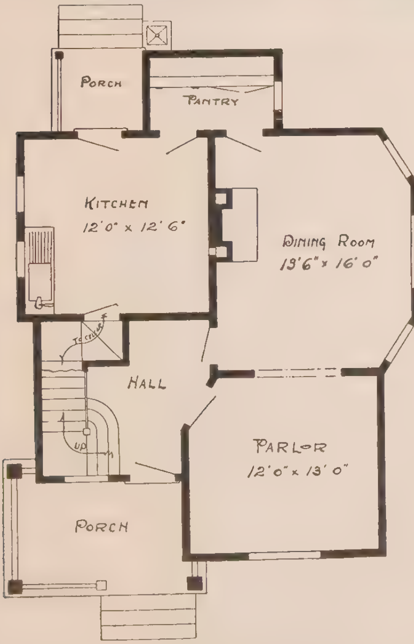
Second Floor Plan

Size: Width, 28 feet 6 inches; length, 37 feet, exclusive of porch

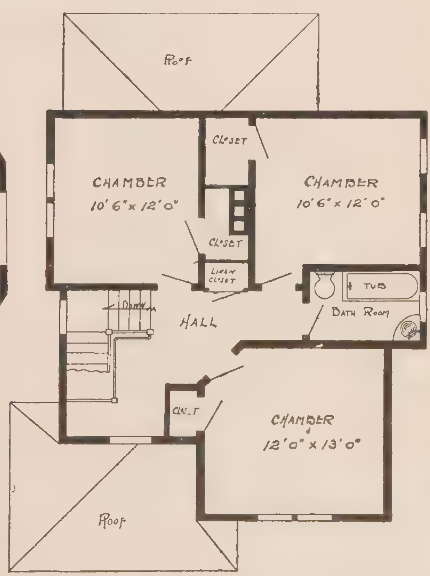
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,525.00 to about $1,775.00, according to the locality in which it is built.

Design No. 1112



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 27 feet 6 inches; length, 29 feet 6 inches, exclusive of porches

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,500.00 to about $1,700.00, according to the locality in which it is built.

Design No. 1523

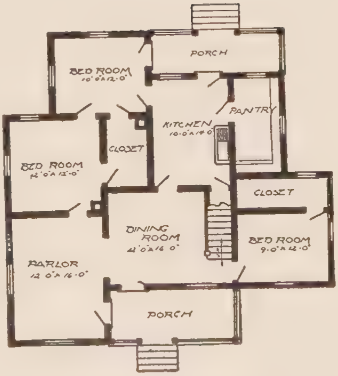
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

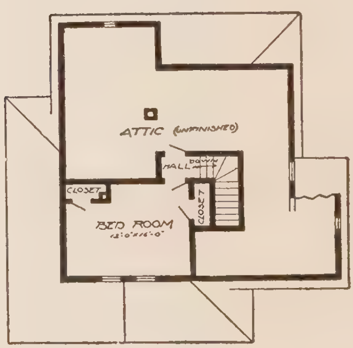
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



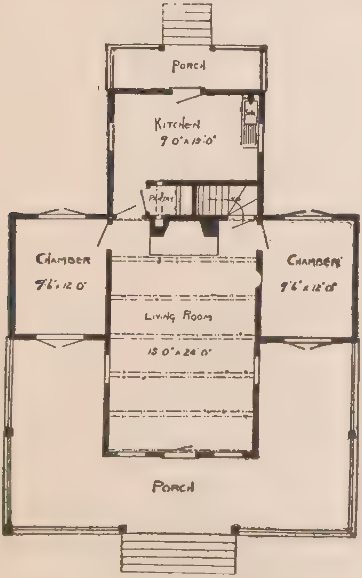
Second Floor Plan

Size: Width, 42 feet; length, 40 feet

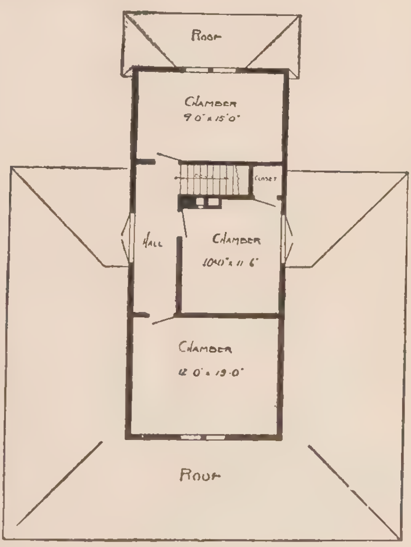
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,200.00 to about $1,400.00, according to the locality in which it is built.

Design No. 1140



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 36 feet; length, 38 feet, exclusive of porches

Blue prints consist of foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $650.00 to about $800.00, according to the locality in which it is built.

Design No. 1127

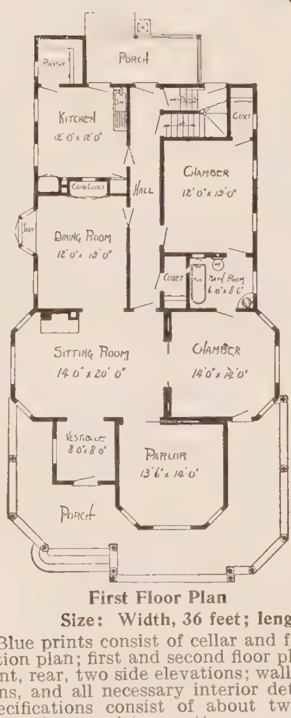
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

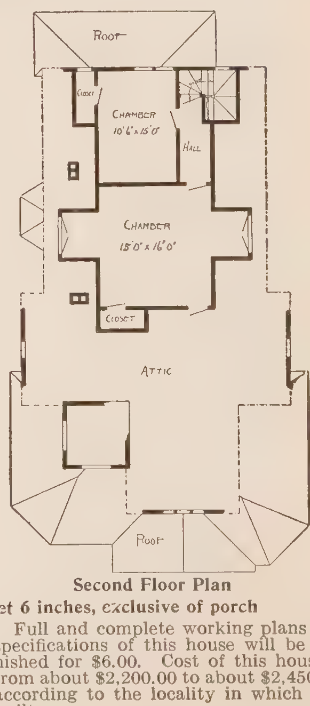
ONLY

$6.00

They save time and prevent waste of material



First Floor Plan



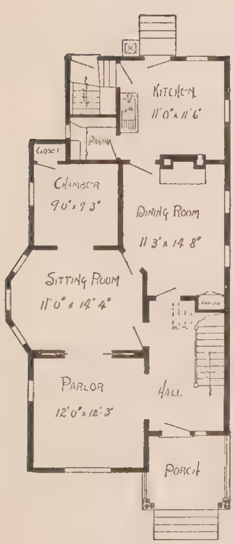
Second Floor Plan

Size: Width, 36 feet; length, 59 feet 6 inches, exclusive of porch

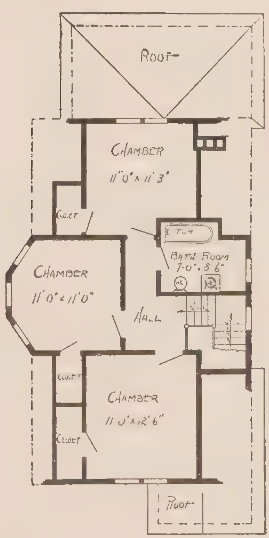
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections, and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $6.00. Cost of this house is from about $2,200.00 to about $2,450.00. according to the locality in which it is built.

Design No. 1124



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 24 feet 6 inches; length, 45 feet 6 inches, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans, front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,450.00 to about $1,700.00, according to the locality in which it is built.

Design No. 1114

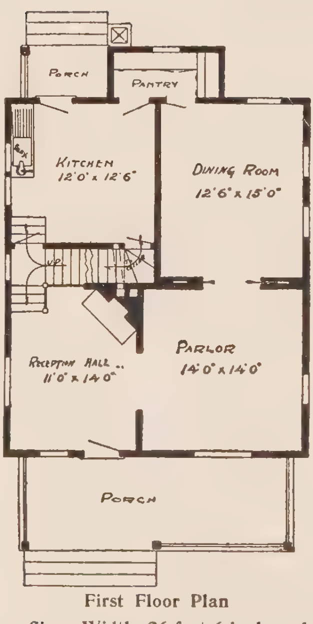
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

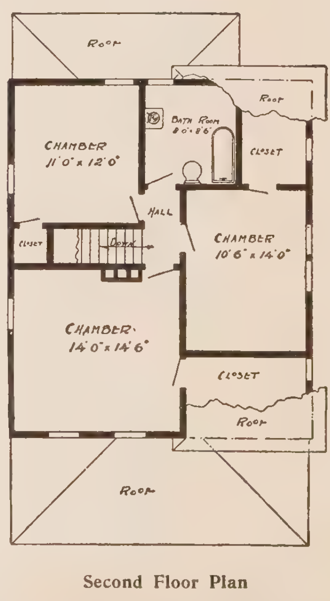
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



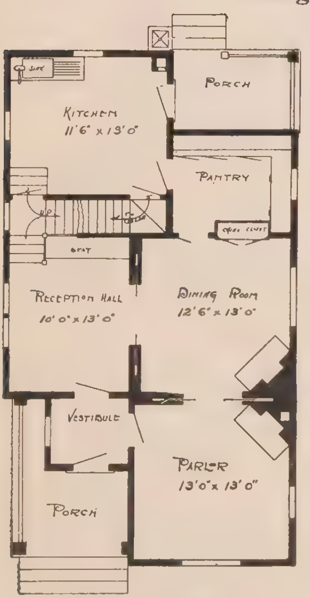
Second Floor Plan

Size: Width, 26 feet 6 inches; length, 30 feet 6 inches, exclusive of porch

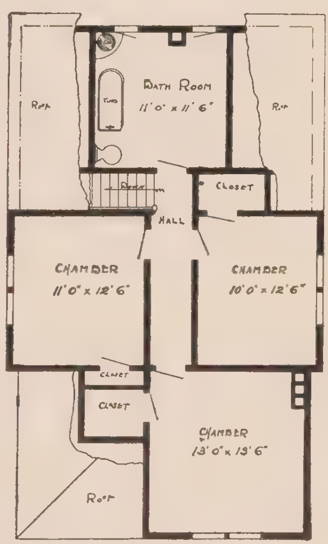
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250.00 to about $1,450.00, according to the locality in which it is built.

Design No. 1113



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 24 feet 6 inches; length, 43 feet

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,525.00 to about $1,750.00, according to the locality in which it is built.

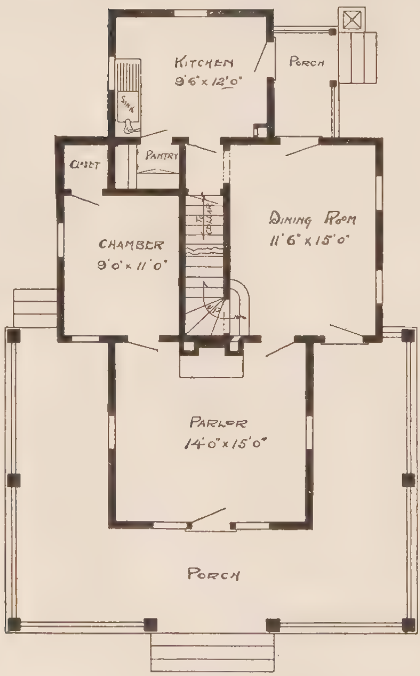
Design No. 1116

PRICE
of Blue Prints, together with a complete set of typewritten specifications is

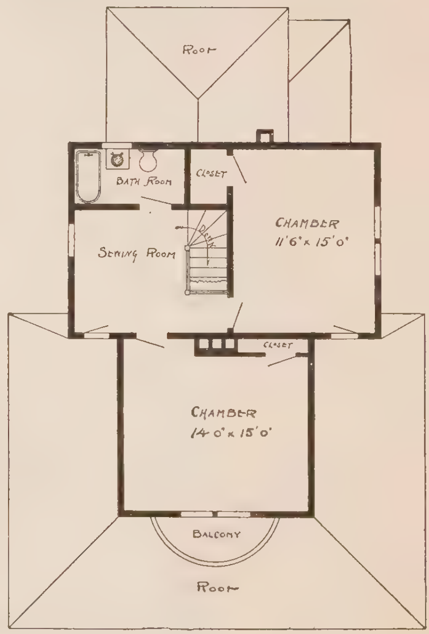
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



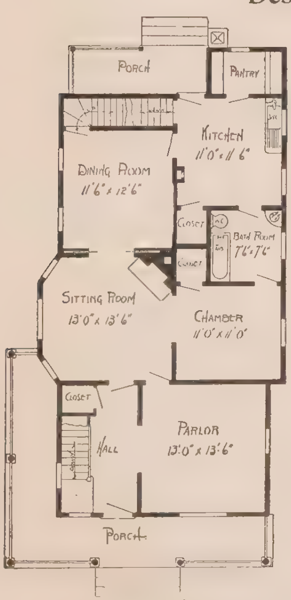
Second Floor Plan

Size: Width, 25 feet 6 inches; length, 40 feet 6 inches, exclusive of porches

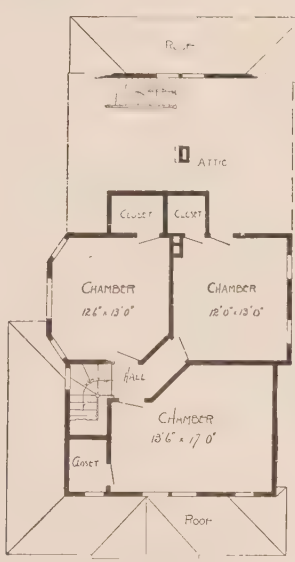
Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,300.00 to about $1,550.00, according to the locality in which it is built.

Design No. 1129



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 26 feet; length, 45 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,100.00, according to the locality in which it is built.

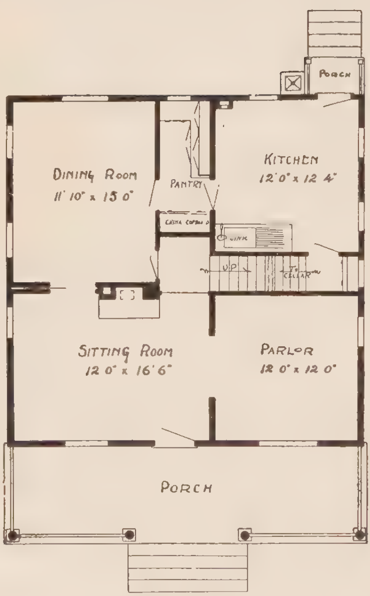
Design No. 1126

PRICE of Blue Prints, together with a complete set of typewritten specifications is

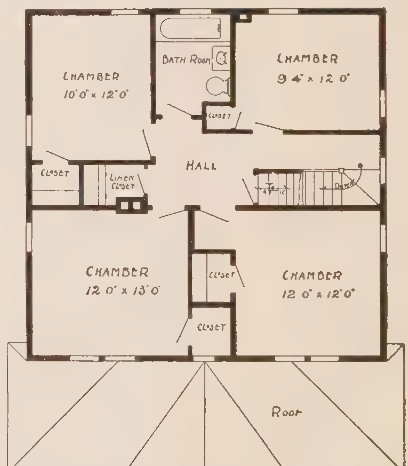
ONLY

$5.00

They save time and prevent waste of material



First Floor Plan



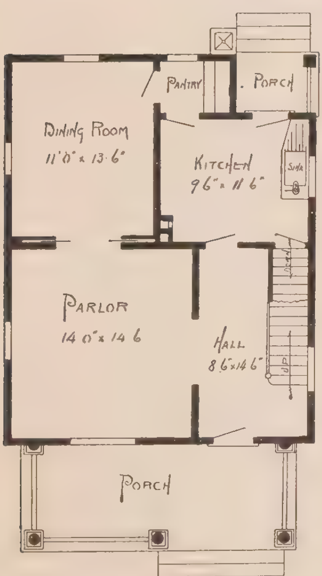
Second Floor Plan

Size: Width, 29 feet 6 inches; length, 28 feet 6 inches, exclusive of porches

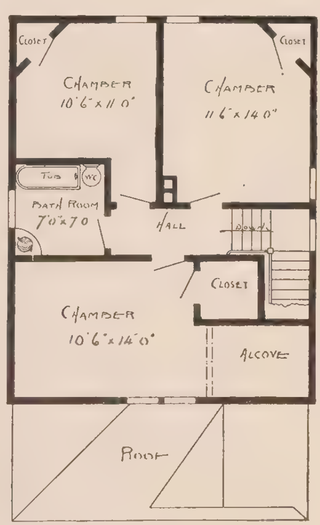
Blue prints consist of cellar and foundation plan; roof and attic; first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,200.00 to about $2,450.00, according to the locality in which it is built.

Design No. 1136



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 24 feet; length, 30 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1 250.00 to about $1,400.00, according to the locality in which it is built.

Design No. 1139

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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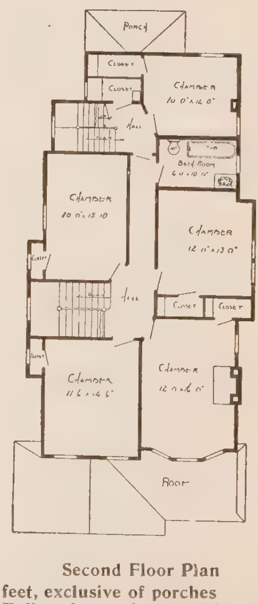
$5.00

They save time and prevent waste of material

First Floor Plan



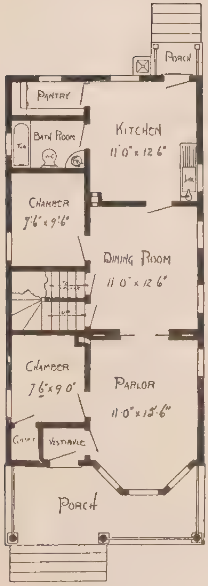
Second Floor Plan

Size: Width, 29 feet; length, 52 feet, exclusive of porches

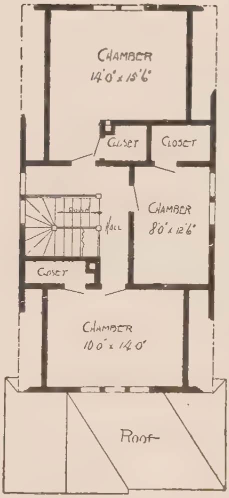
Blue prints consist of cellar and foundation plan; attic and roof plan; first and second floor plans, front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about 20 pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,450.00 to about $2,675.00, according to the locality in which it is built.

Design No. 1128



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

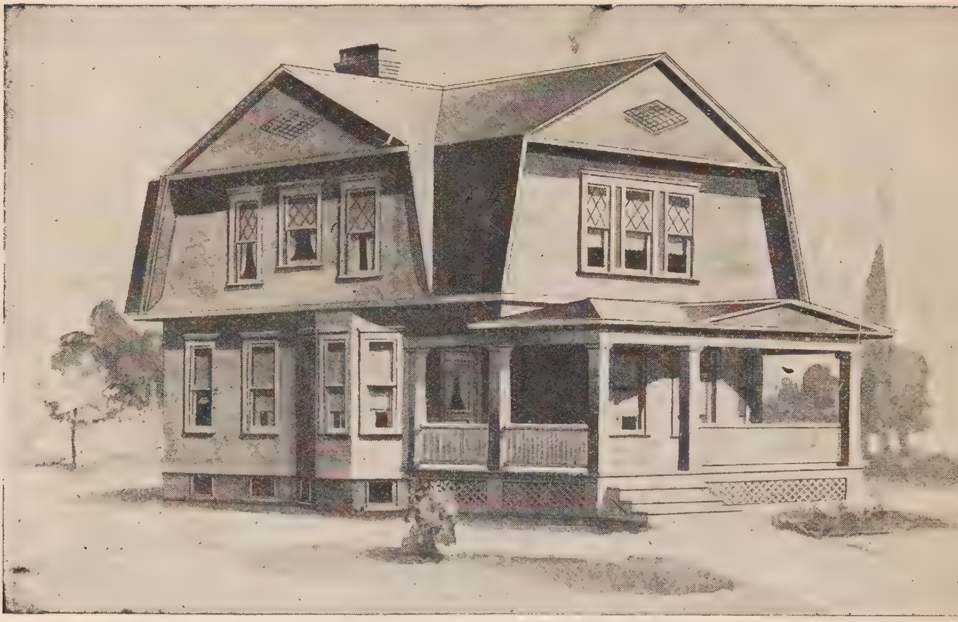
$5.00

They save time and prevent waste of material

Size: Width, 20 feet; length, 43 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,350.00 to about $1,500.00, according to the locality in which it is built.



Design No. 1145

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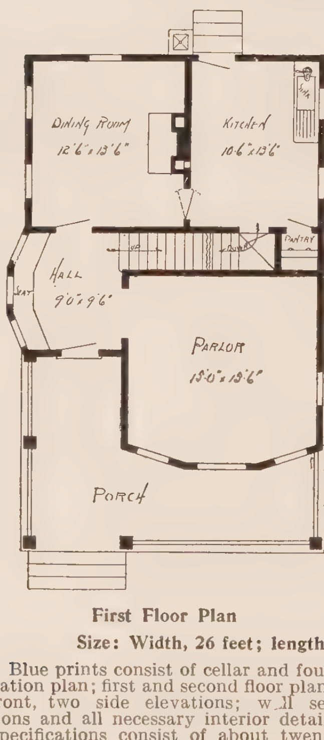
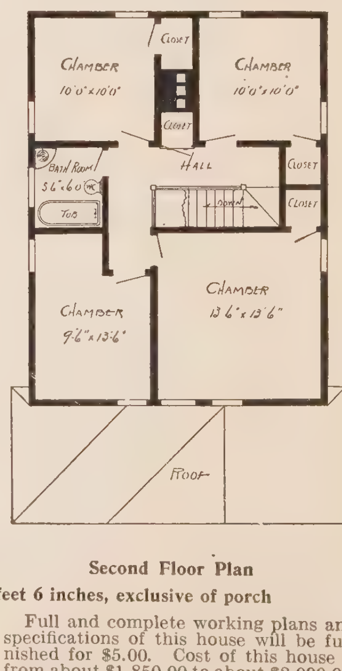


First Floor Plan



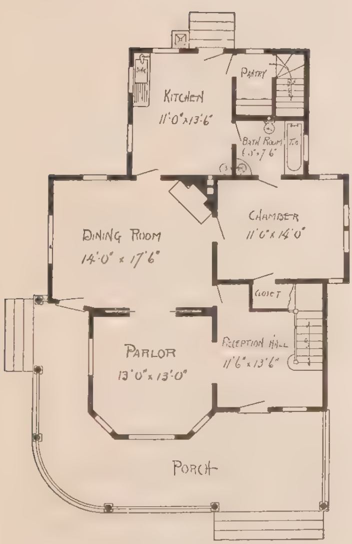
Second Floor Plan

Size: Width, 26 feet; length, 33 feet 6 inches, exclusive of porch

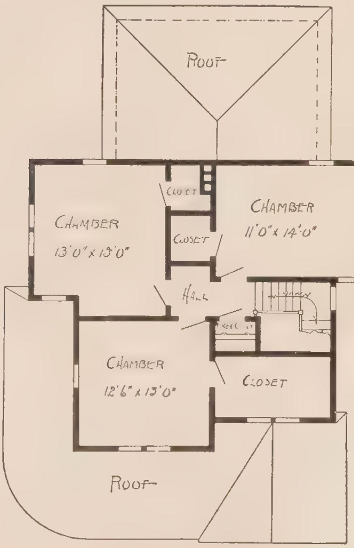
Blue prints consist of cellar and foundation plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,000,00, according to the locality in which it is built

Design No. 1125



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 33 feet; length, 43 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,500.00 to about $1,700.00, according to the locality in which it is built.

Design No. 1141

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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$15.00

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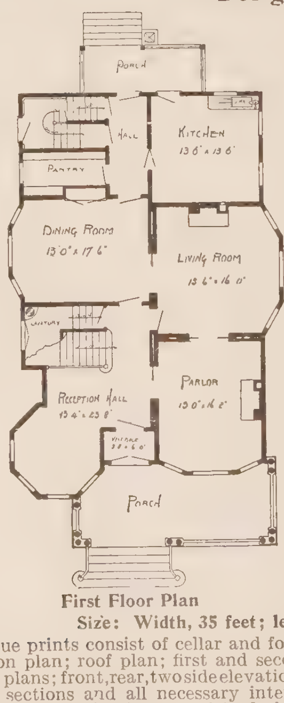
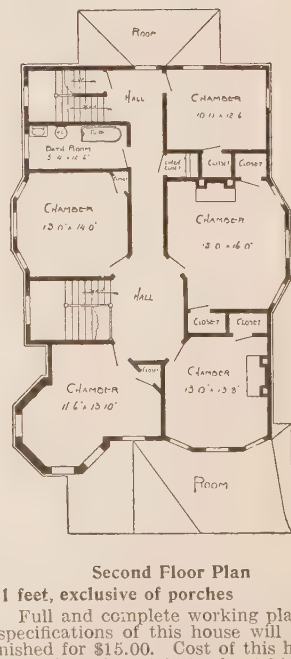


First Floor Plan



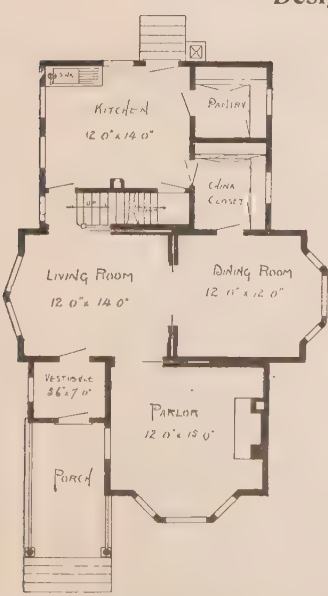
Second Floor Plan

Size: Width, 35 feet; length, 51 feet, exclusive of porches

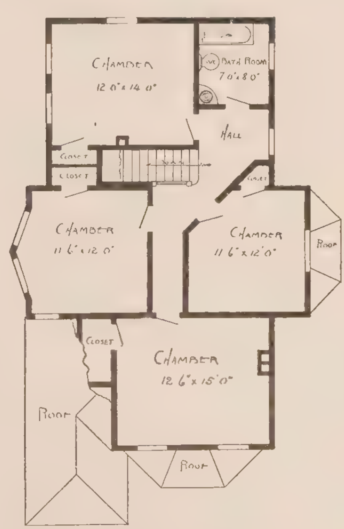
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $15.00. Cost of this house is from about $3,900.00 to about $4,200.00, according to the locality in which it is built.

Design No. 1137



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

They save time and prevent waste of material

Size: Width, 31 feet 6 inches; length, 45 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,950.00 to about $2,175.00, according to the locality in which it is built.

Design No. 1142

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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$5.00

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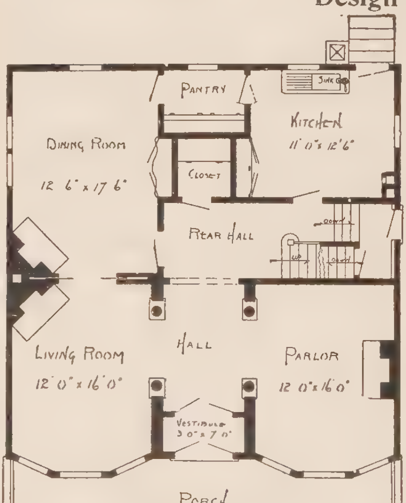
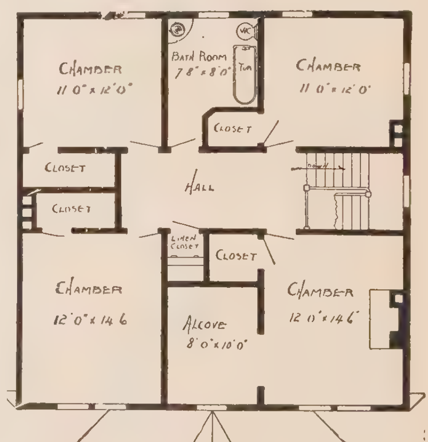


First Floor Plan

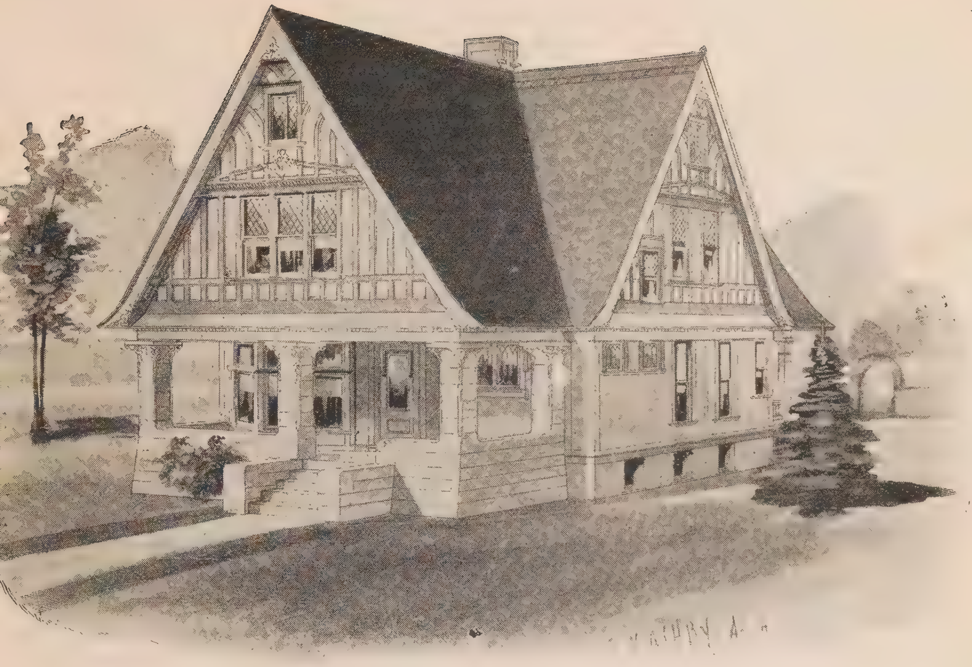


Second Floor Plan

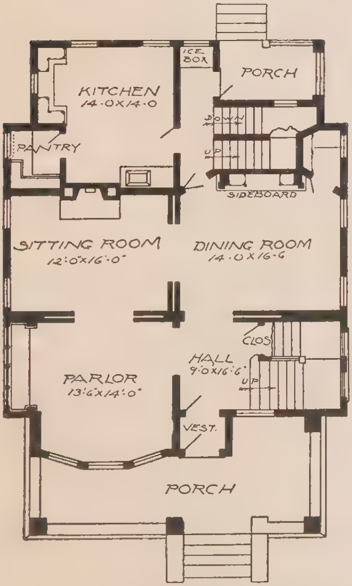
Size: Width, 34 feet; length, 35 feet 6 inches, exclusive of porch

Blue prints consist of cellar and foundation plan; roof plan, first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

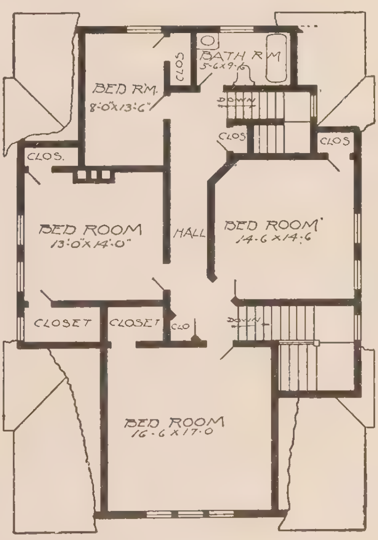
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,100.00 to about $2,350.00, according to the locality in which it is built.



Design No. 1543



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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$15.00

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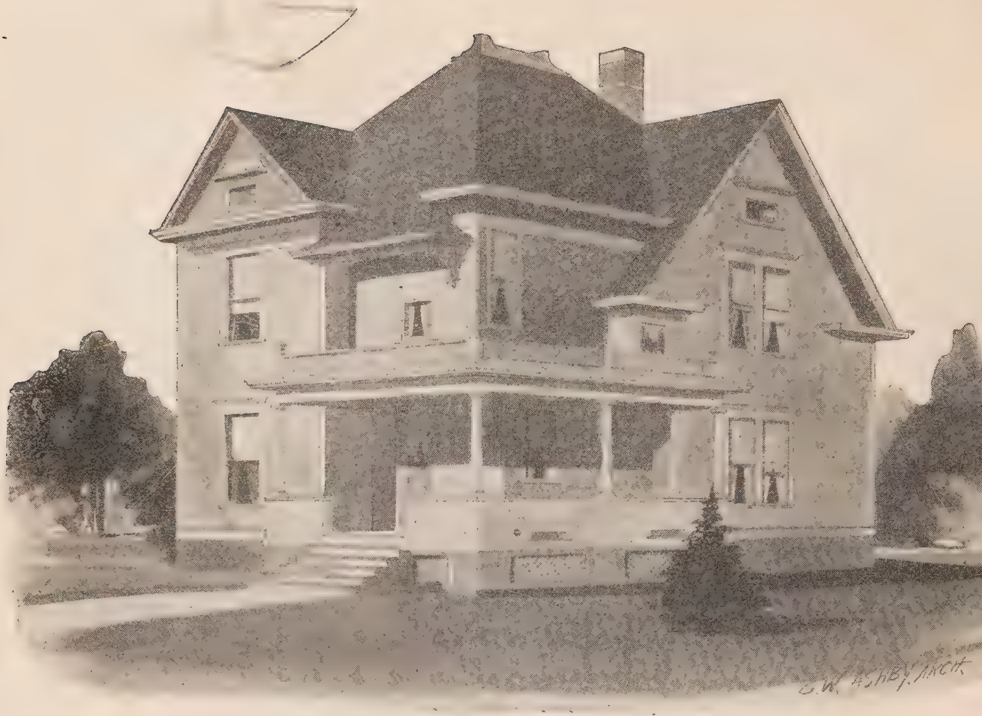
Size: Width, 35 feet; length, 42 feet

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about thirty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $15.00. Cost of this house is from about $3,850.00 to about $4,150.00, according to the locality in which it is built.



Design No. 1511

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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$5.00

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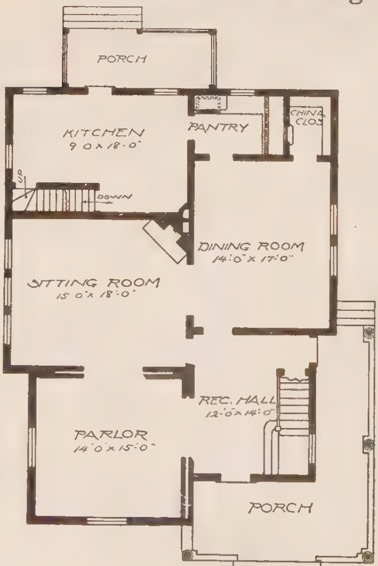
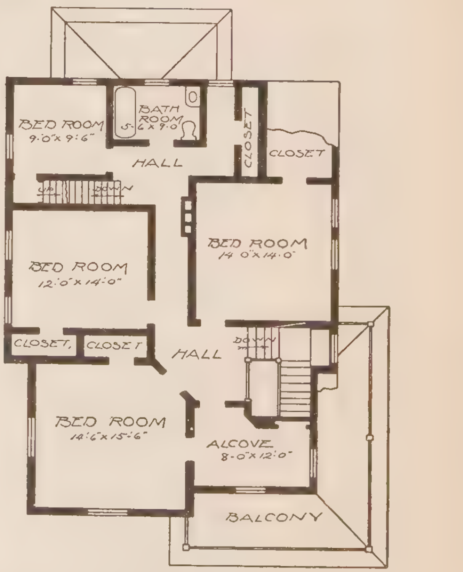


First Floor Plan



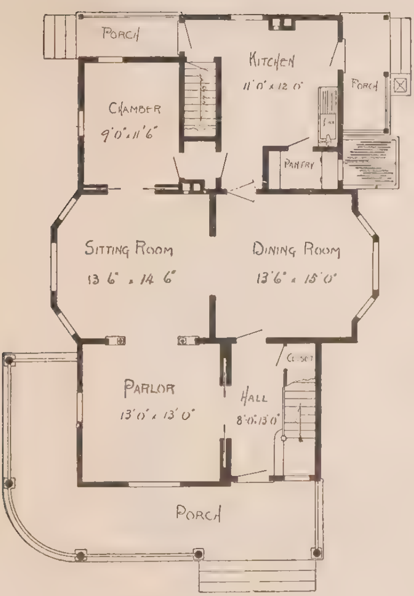
Second Floor Plan

Size: Width, 33 feet 6 inches; length, 43 feet 6 inches, exclusive of porches

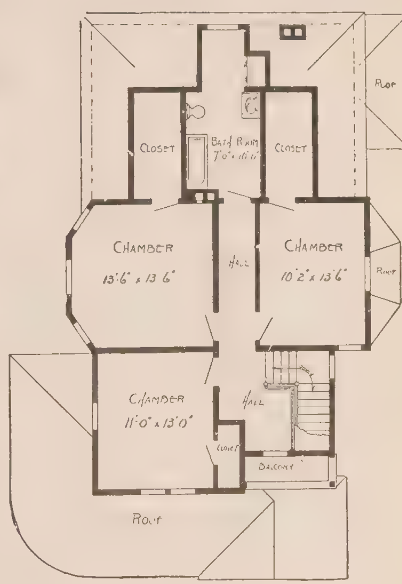
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,200.00 to about $2,500.00, according to the locality in which it is built.

Design No. 1130



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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Size: Width, 29 feet; length, 44 feet 6 inches, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,900.00 to about $2,150.00, according to the locality in which it is built.

Design No. 1533

PRICE

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$3.00

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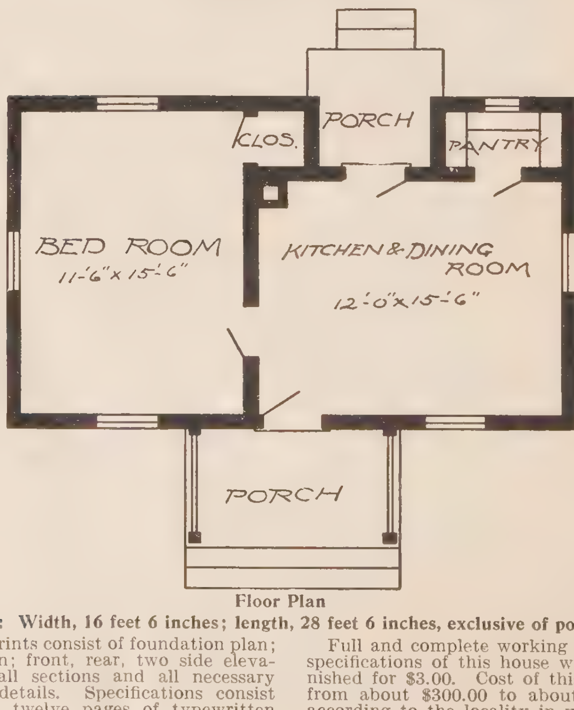
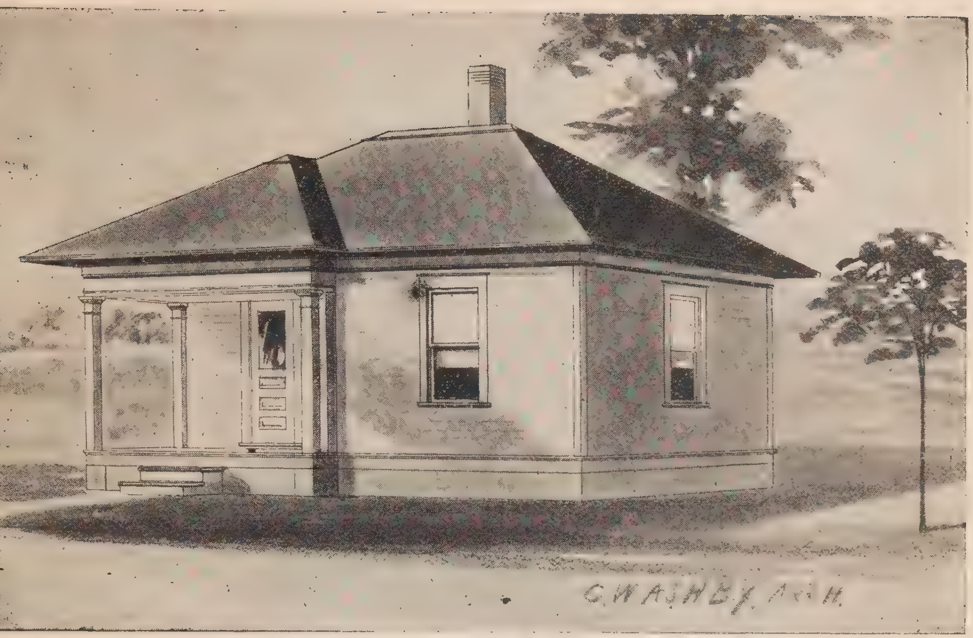


Floor Plan

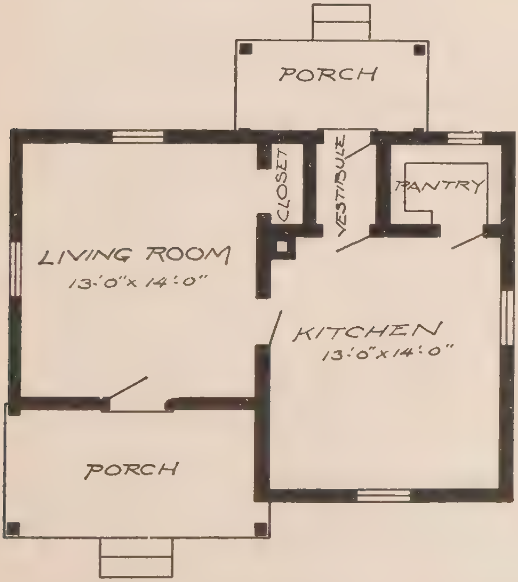
Size: Width, 16 feet 6 inches; length, 28 feet 6 inches, exclusive of porches

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twelve pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $3.00. Cost of this house is from about $300.00 to about $450.00, according to the locality in which it is built.



Design No. 1541



PRICE of Blue Prints, together with a complete set of typewritten specifications is

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Floor Plan

Size: Width, 27 feet 6 inches; length, 20 feet, exclusive of porch

Blue prints consist of foundation plan; floor plan; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twelve pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $600.00 to about $700.00, according to the locality in which it is built.

Design No. 1552

PRICE
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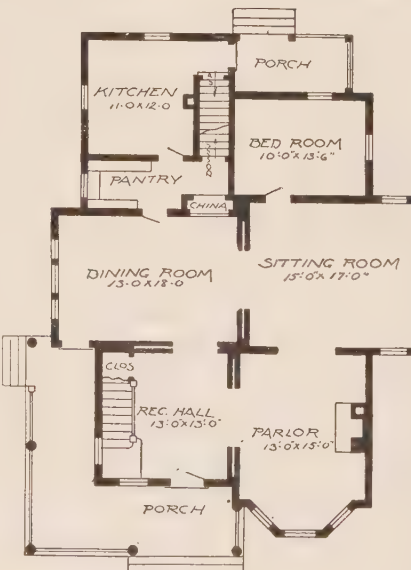
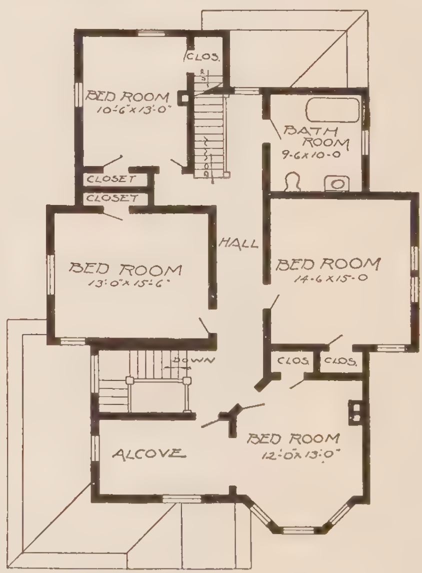


First Floor Plan



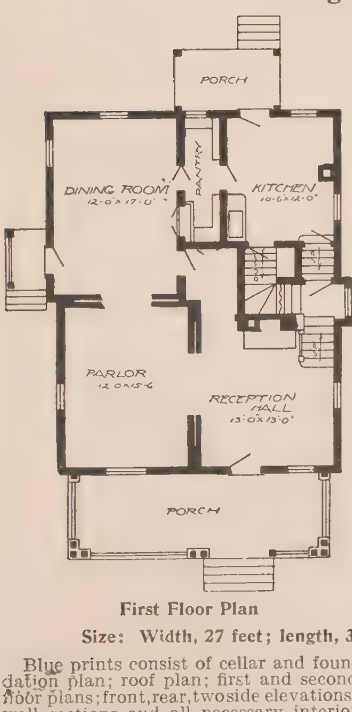
Second Floor Plan

Size: Width, 37 feet 6 inches; length, 51 feet, exclusive of porches

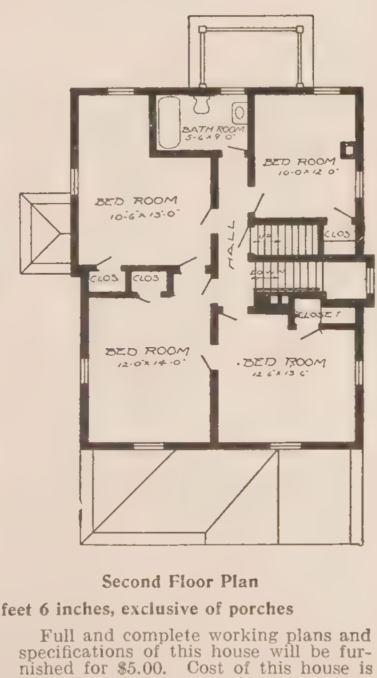
Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $4,500.00 to about $4,800.00, according to the locality in which it is built.

Design No. 1504



First Floor Plan



Second Floor Plan

PRICE

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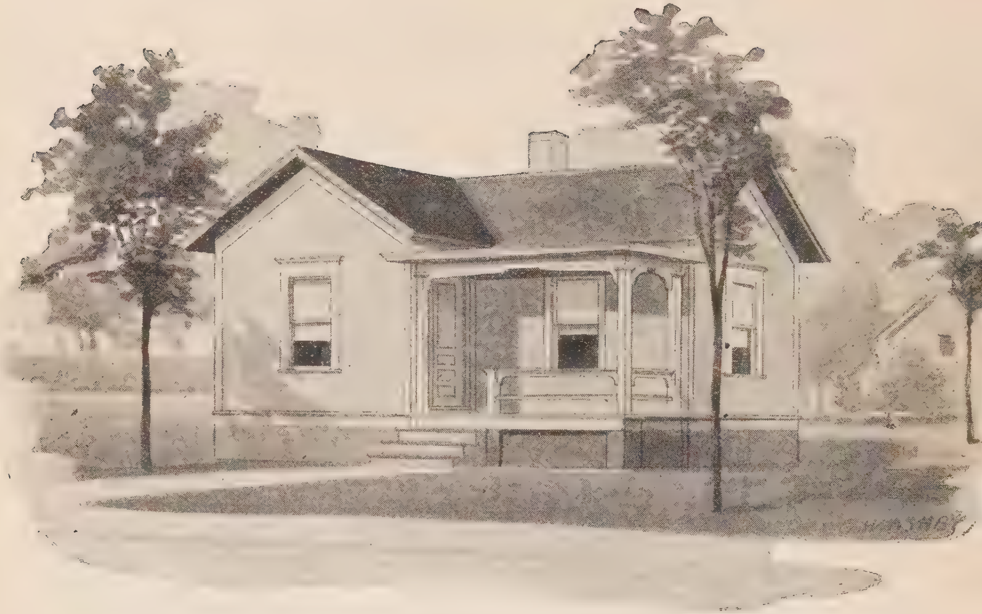
Size: Width, 27 feet; length, 34 feet 6 inches, exclusive of porches

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,600.00 to about $1,800.00, according to the locality in which it is built.



Design No. 1534

PRICE

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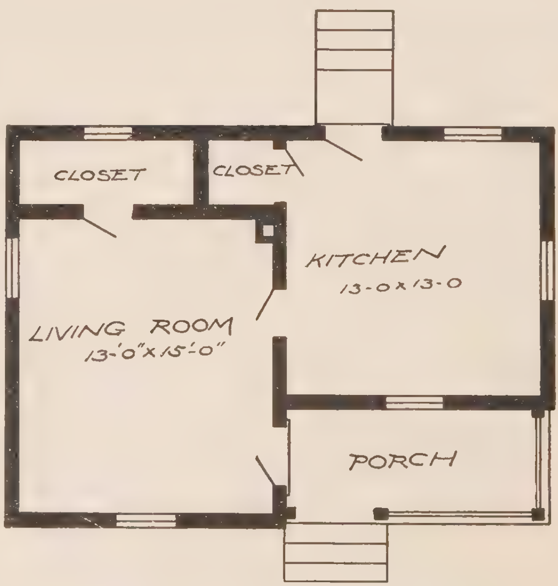


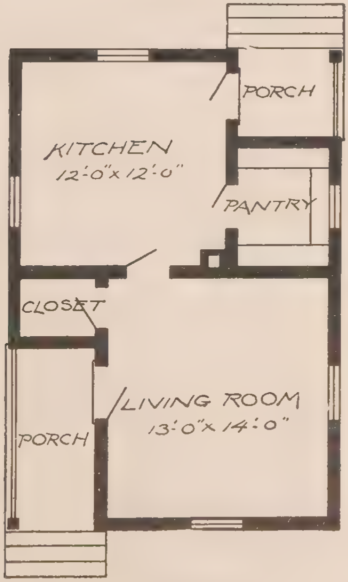
Floor Plan

Size: Width, 27 feet 6 inches; length, 20 feet

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $3.00. Cost of this house is from about $475.00 to about $575.00, according to the locality in which it is built.

Design No. 1531



Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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Size: Width, 19 feet; length, 27 feet 6 inches

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twelve pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $3.00. Cost of this house is from about $400.00 to about $500.00, according to the locality in which it is built.

Design No. 1512

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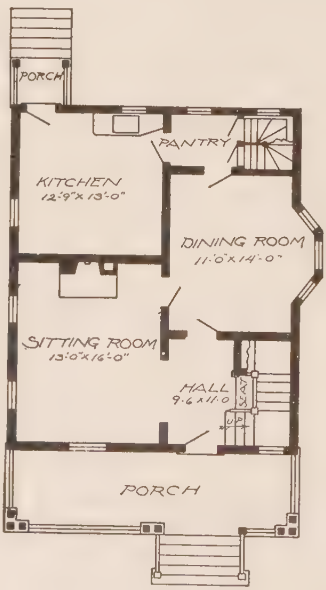
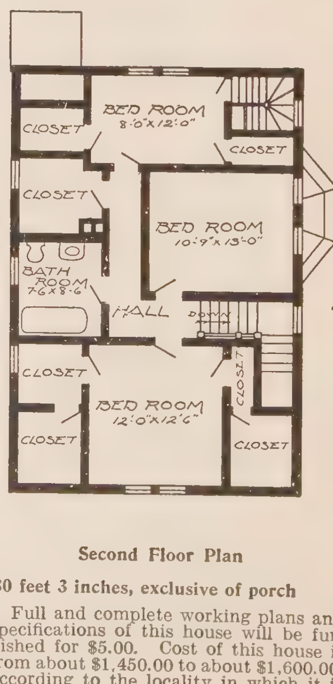


First Floor Plan



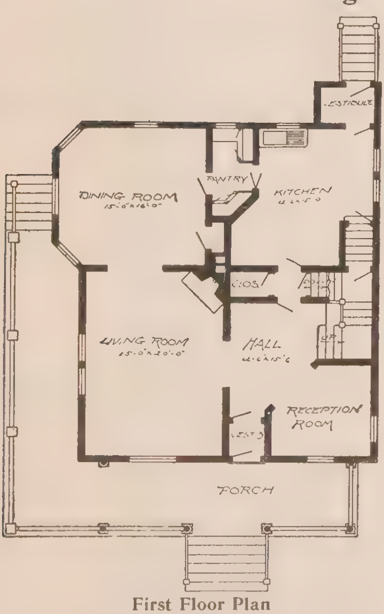
Second Floor Plan

Size: Width, 27 feet 6 inches; length, 30 feet 3 inches, exclusive of porch

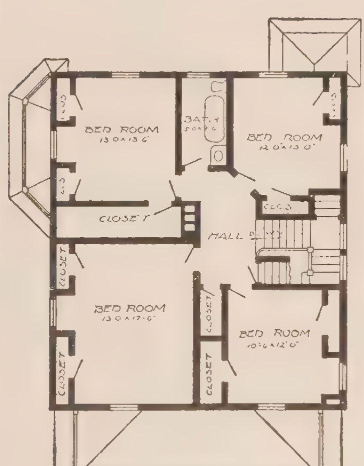
Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,450.00 to about $1,600.00, according to the locality in which it is built.

Design No. 1528



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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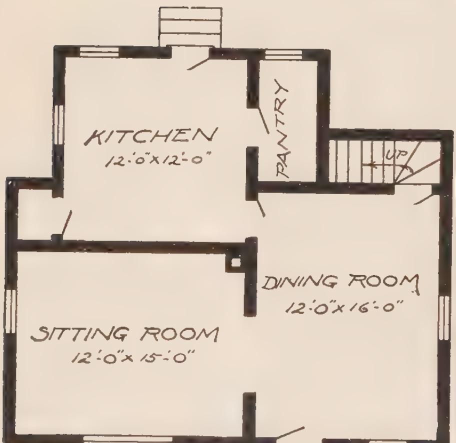
Size: Width, 32 feet; length, 36 feet 6 inches, exclusive of porch

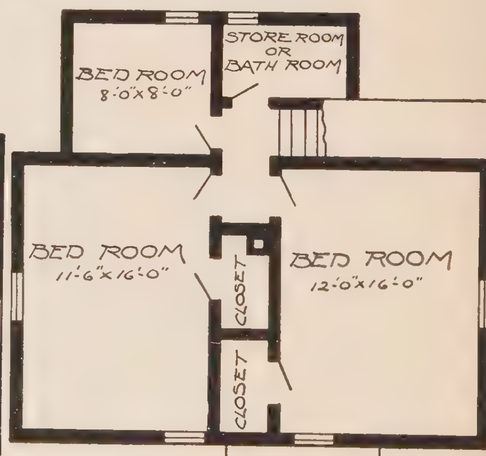
Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,950.00 to about $2,250.00, according to the locality in which it is built.

Design No. 1539



First Floor Plan



Second Floor Plan

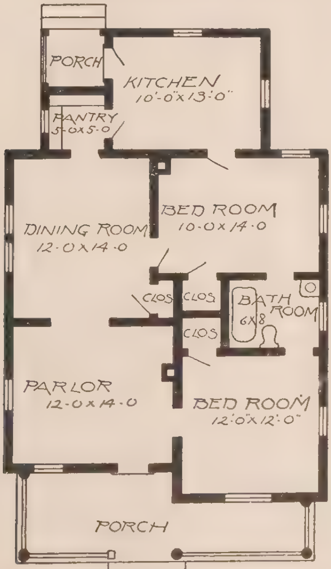
PRICE of Blue Prints, together with a complete set of typewritten specifications, only **$5.00.** They save time and prevent waste of material.

Size: Width, 28 feet 6 inches; length, 25 feet 6 inches, exclusive of porch

Blue prints consist of foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $850.00 to about $1,000.00, according to the locality in which it is built.

Design No. 1556



PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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$5.00

They save time and prevent waste of material

Floor Plan

Size: Width, 27 feet 6 inches; length, 40 feet 6 inches, exclusive of porches

Blue prints consist of foundation plan roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,050.00 to about $1,200.00, according to the locality in which it is built.

Design No. 1536

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

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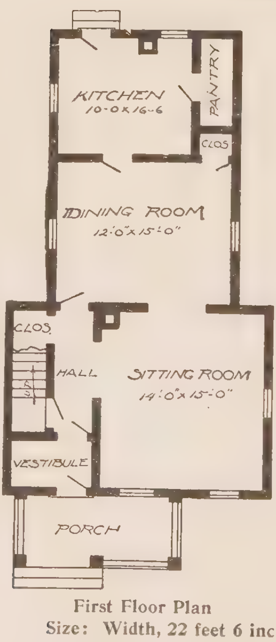
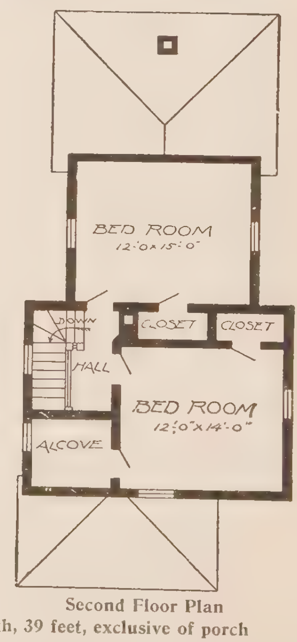
$5.00

They save time and prevent waste of material



First Floor Plan



Second Floor Plan

Size: Width, 22 feet 6 inches; length, 39 feet, exclusive of porch

Blue prints consist of foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $700.00 to about $900.00, according to the locality in which it is built.

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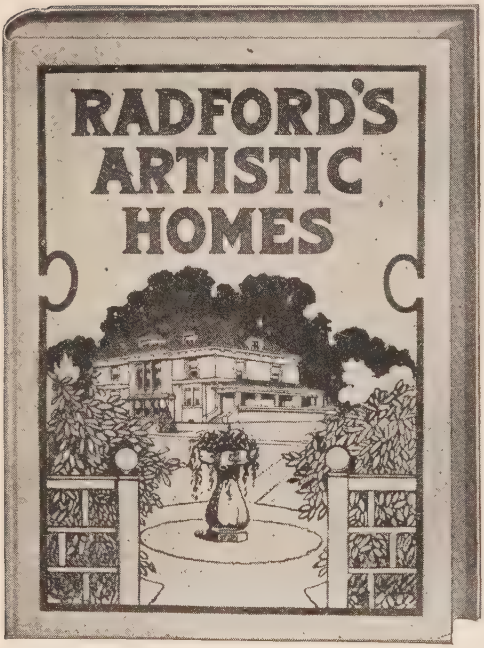

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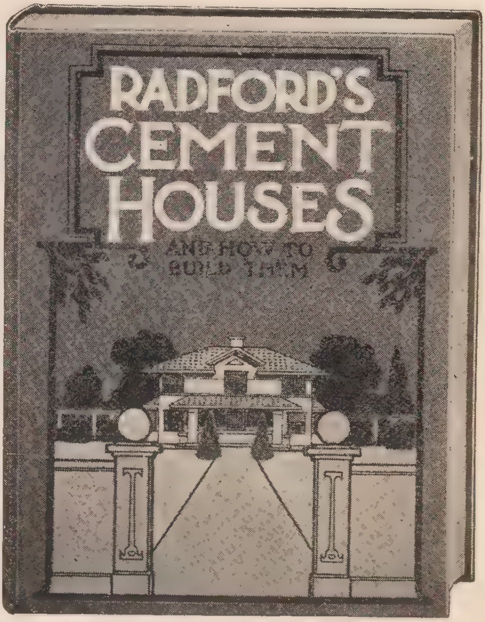

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In these days of timber and cement houses, brick and cement houses, and other combinations of materials, the builder and contractor who wants to be ready to do work on all kinds of residence construction should study the latest methods and most practical and economical ways of doing his work. He should be prepared to accept contracts on any type of construction, be able to estimate accurately and understand all details. New and odd ways of combining frame, stucco, concrete blocks and veneered brick are constantly being employed, and the builder who does not have the advantage of practical experience on this unusual work is under a serious handicap.

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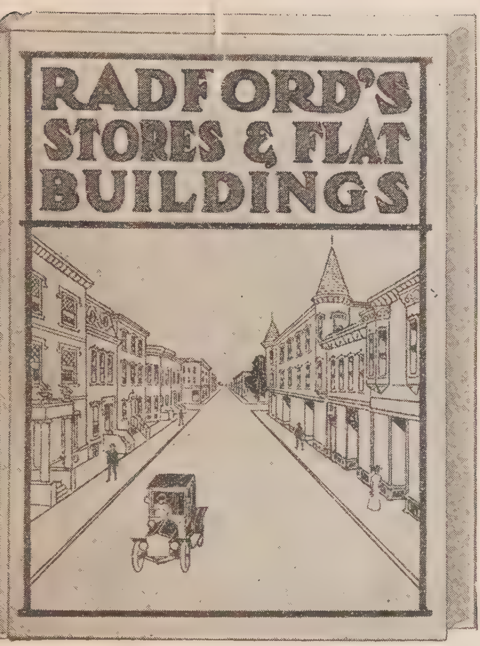
Stores and Flat Buildings



This book is entirely different from any book of Architectural Plans ever published, as it is composed of perspective views and plans designed both for city and country buildings. Nothing like it has ever before been within the reach of any one desiring to build for himself or others.

Only Book of Its Kind

"Stores and Flat Buildings" is actually the first and only book of its kind ever published. In other plan books designs are shown for single residences to be constructed on separate lots, but in this book are given ideas for the man who wants to have his store on the first floor and live above it, or rent the upper floor or floors. These designs combine business and residence structures, and also give the

Latest Ideas and Designs

in Flat Buildings of two, four, six and nine apartments. In nearly all good sized towns and villages small flat buildings, combined with stores or entirely for residence purposes, are becoming more and more popular, and are proving very popular. In the suburbs of large cities small flats or apartments are being built more than any other type of construction.

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For Country and City

In addition to the designs for stores, combined stores and flat buildings and separate flat buildings, this book also illustrates small bank buildings, lodge halls and double houses suitable for the small towns and villages as well as the larger cities. In many small towns there is a demand for suitable places of gathering for societies and lodges, and in numerous cases the contractor and builder, having had no experience in this line of work, believes it necessary to apply to an architect in a larger place to get correct plans drawn especially to order. The contractor and builder, with this book on hand, can take care of this work himself and secure correct and guaranteed plans at a trifling cost, plans that have been built from and found satisfactory in every particular. The same is true of bank buildings, of which a good selection is shown.

An Up-to-Date Book for Builders

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